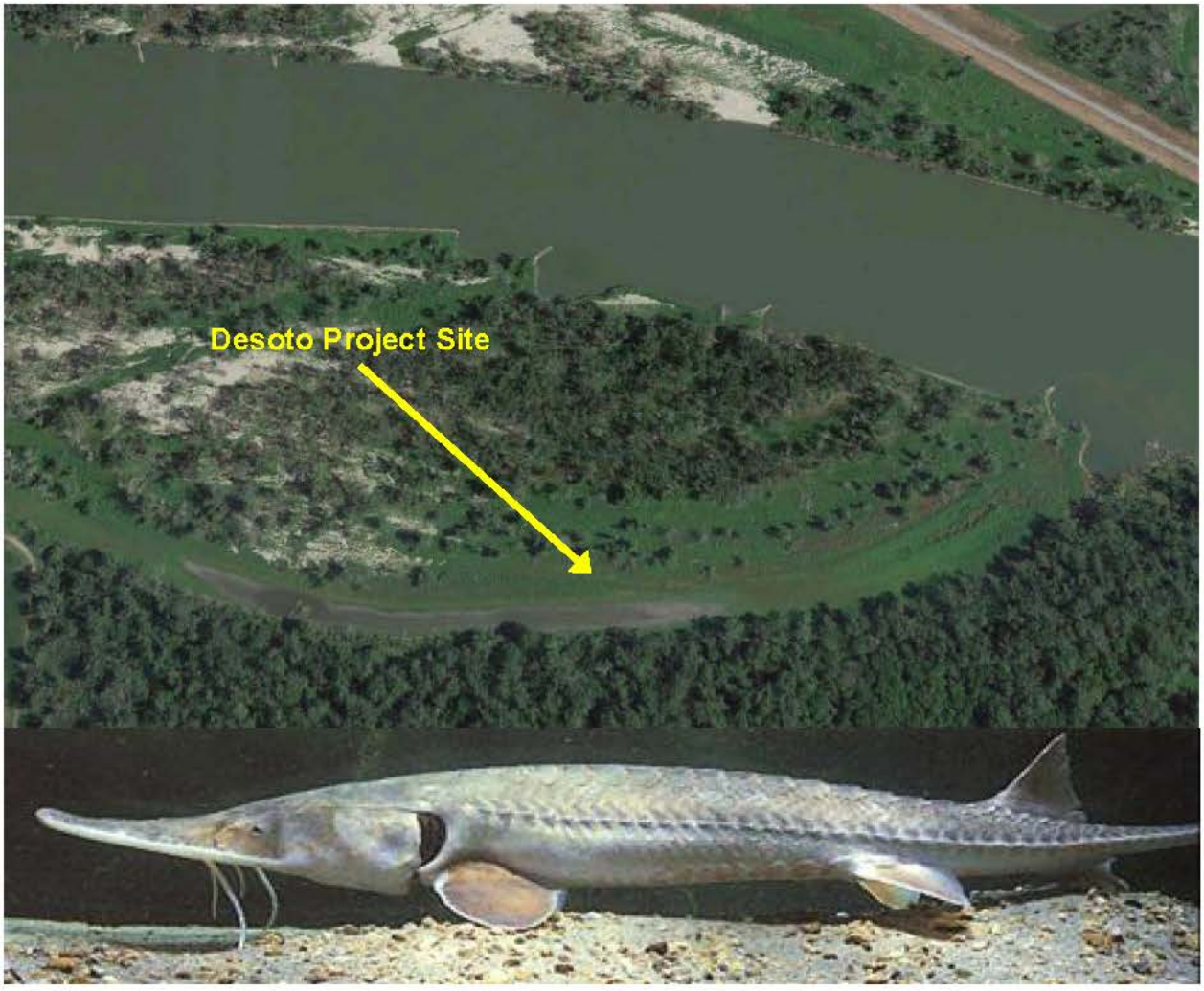
U.S. Army Corps of Engineers
Omaha District

Water Quality Sampling Report and Factual Determinations

Results of Sediment Sampling and Elutriate Testing at the Proposed Desoto Shallow Water Habitat Project Site



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Water Quality Sampling Report
and
Factual Determinations

Results of Sediment Sampling and Elutriate Testing at the Proposed Desoto Shallow Water Habitat Project Site

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Water Control and Water Quality Section
Hydrologic Engineering Branch
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U.S. Army Corps of Engineers

August 2013

TABLE OF CONTENTS

1 BACKGROUND INFORMATION

1.1 Project Description

A project is being proposed to enhance shallow-water habitat (SWH) along the Desoto Cutoff of the Missouri River in Harrison County, Iowa. The U.S. Army Corps of Engineers (USACE) is constructing SWH along the lower Missouri River downstream of Gavins Point Dam to mitigate aquatic habitat lost from past bank stabilization and channelization, and enhance habitat for the endangered pallid sturgeon (*Scaphirhynchus albus*) population along the lower Missouri River. The Omaha District (District) is referring to the proposed project as the Desoto project. Deposited sediment will be excavated at the project site to create backwater habitat. Hydraulic dredging is proposed for sediment excavation with the dredge spoil being discharged to the adjacent Missouri River. It is believed the sediment/soil to be dredged will be primarily alluvial material. An estimated 240,000 cubic yards of sediment/soil could be excavated and discharged to the Missouri River.

1.2 Project Location

The proposed Desoto project site is located along the Missouri River at RM644 (Figure 1). Although on the Nebraska side of the Missouri River, the project area is in the legal jurisdiction of Iowa (Harrison County). Figure 2 indicates the proposed areas to be excavated at the Desoto project site.

1.3 Section 404 Permitting Requirements – 404(b)(1) Guidelines

Section 404 of the Federal Clean Water Act (CWA) requires that a §404 permit be appropriately obtained prior to the discharge of any dredge or fill material into waters of the United States. The issuance of §404 permits is pursuant to the Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material [40 CFR Ch. I (7-1-10 Edition)]. Fundamental to the 404(b)(1) Guidelines is the precept that dredged or fill material should not be discharged into the aquatic ecosystem, unless it can be demonstrated that such a discharge will not have an unacceptable adverse impact either individually or in combination with known and/or probable impacts of other activities affecting the ecosystems of concern. No discharge of dredged or fill material is permitted: 1) if it will cause or contribute, after consideration of disposal site dilution and dispersion, to violations of any applicable State water quality standard; 2) if it will cause or contribute to significant degradation of the waters of the United States; or 3) unless appropriate and practicable steps have been taken which will minimize potential adverse impacts of the discharge on the aquatic system.

Compliance with the 404(b)(1) Guidelines is based, in part, on "Factual Determinations" of the potential impact of the proposed dredge and fill on the aquatic environment. The §404 permitting authority is required to determine in writing the potential short-term or long-term effects of a proposed discharge of dredged or fill material on the physical, chemical, and biological components of the aquatic environment. These Factual Determinations are used in making findings of compliance or non-compliance with the restrictions on discharge. The 404(b)(1) Guidelines at §230.11 identify the following eight Factual Determinations that are to be made on the effects of each proposed discharge of dredge and fill material:

1) Physical substrate determinations.
2) Water circulation, fluctuation, and salinity determinations.
3) Suspended particulate/turbidity determinations.
4) Contaminant determinations.
5) Aquatic ecosystem and organism determinations.

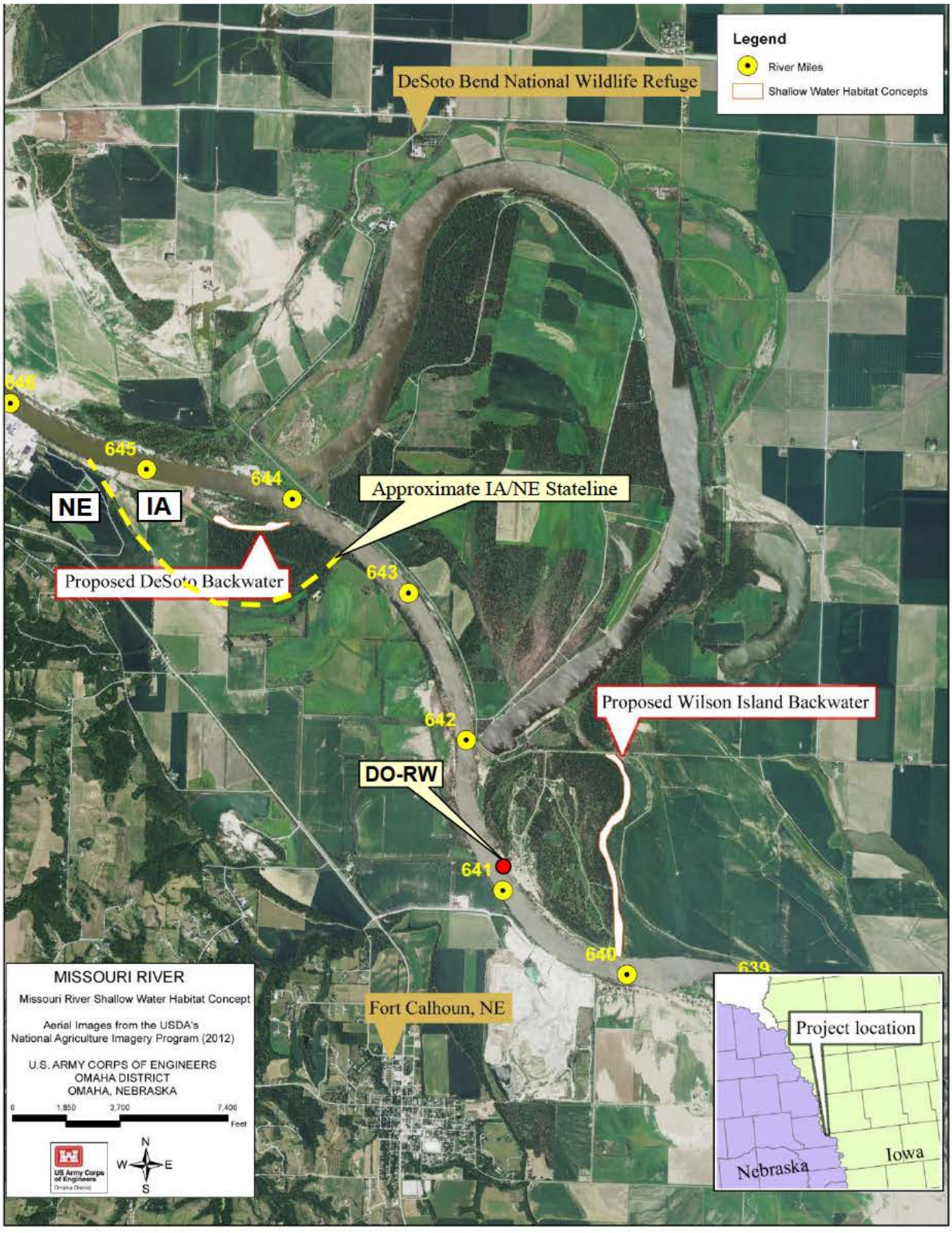

Figure 1. Location of proposed Desoto shallow water habitat project site along the Missouri River at RM640.

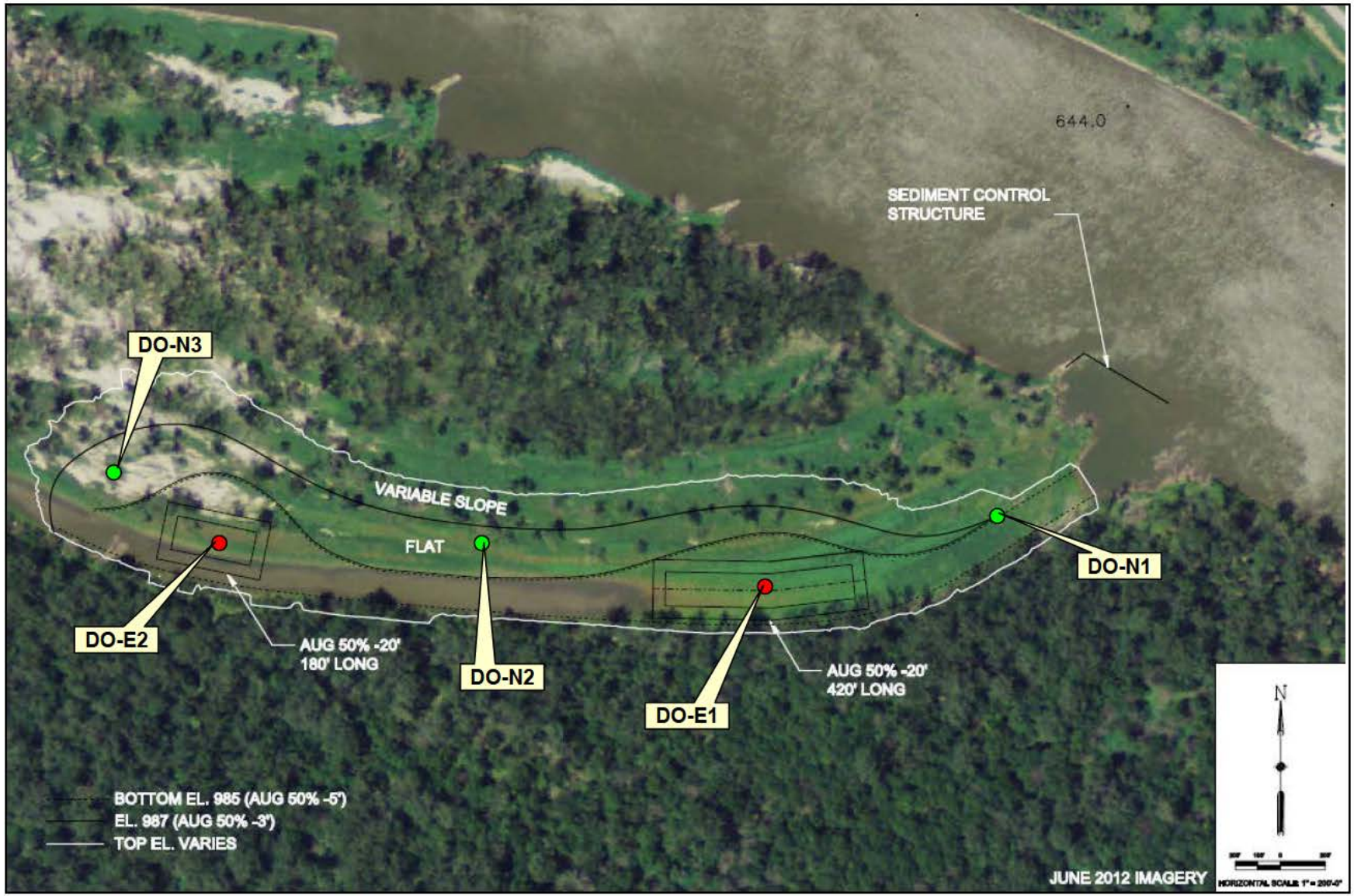

Figure 2. Proposed area to be excavated to create shallow-water habitat at the proposed Desoto project area. Locations where sediment/soil samples were collected are shown.

6) Proposed disposal site determinations.
7) Determination of cumulative effects on the aquatic ecosystem.
8) Determination of secondary effects on the aquatic ecosystem.

The intent of this report is to provide Factual Determinations of the potential water quality impacts of the proposed hydraulic dredging discharge at the Desoto project site on the Missouri River. As defined in the Federal CWA and USACE Regulation No. 1110-2-8154, water quality is defined as the physical, chemical, and biological characteristics of water. This report specifically provides information for water quality Factual Determinations regarding:

- Physical substrate determinations,
- Suspended particulate/ turbidity determinations,
- Contaminant determinations,
- Proposed disposal site determinations.

The following describe the Factual Determinations that are to be made pursuant to the 404(b)(1) Guidelines regarding water quality impacts.

1.3.1 Physical Substrate Determinations

Determine the nature and degree of effect that the proposed discharge will have on the characteristics of the substrate at the proposed disposal site. Consideration shall be given to the similarity in particle size, shape, and degree of compaction of the material proposed for discharge and the material constituting the substrate at the disposal site, and any potential changes in substrate elevation and bottom contours, including changes outside of the disposal site which may occur as a result of erosion, slumpage, or other movement of the discharged material.

1.3.2 Suspended Particulate/Turbidity Determinations

Determine the nature and degree of effect that the proposed discharge will have in terms of potential changes in the kinds and concentrations of suspended particulate/turbidity in the vicinity of the disposal site. Consideration is to be given to the grain size of the material proposed for discharge, the shape and size of the plume of suspended particulates, the duration of the discharge and resulting plume and whether or not the potential changes will cause violations of applicable water quality standards.

1.3.3 Contaminant Determinations

Determine the degree to which the material proposed for discharge will introduce, relocate, or increase contaminants. This determination shall consider the material to be discharged, the aquatic environment at the proposed disposal site, and the availability of contaminants.

1.3.4 Proposed Disposal Site Determinations

The disposal site is specified through the application of the 404(b)(1) Guidelines. The mixing zone associated with the discharge is to be confined to the smallest practicable zone that is consistent with the type of dispersion determined to be appropriate. In a few special cases under unique environmental conditions, where there is adequate justification to show that widespread dispersion by natural means will result in no significantly adverse environmental effects, the discharged material may be intended to be spread naturally in a very thin layer over a large area of the substrate rather than be contained within the disposal site.

1.4 Section 401 Water Quality Certification

Under §401 of the Federal CWA an applicant for a federal license or permit (i.e. §404 permit) must obtain a certification that the discharge and activity is consistent with State or Tribal effluent limitations (CWA §301), water quality related effluent limitations (CWA §302), water quality standards and implementation plans (CWA §303), national standards of performance (§306), toxic and pretreatment effluent standards (CWA §307) and "any other appropriate requirement of State or Tribal law set forth in such certification." Regarding the Desoto project, a §401 water quality certification will be requested from the Iowa Department of Natural Resources (IDNR). This report and water quality Factual Determinations will be provided to the IDNR to appropriately facilitate their water quality certification review pursuant to §401, and to the Nebraska Department of Environmental Quality for information purposes.

1.5 Water Quality Standards Classifications of the Missouri River

1.5.1 Iowa

The State of Iowa designates the following uses to the Missouri River from the Iowa-Missouri state line to the confluence with the Big Sioux River: Primary Contact Recreation, Warmwater Type 1 Aquatic Life, and Human Health. The Missouri River at the Council Bluffs water works intake is also designated a use of raw water source of potable water supply. Pursuant to Iowa's antidegradation policy, the Missouri River in the vicinity of the proposed Desoto project is not identified as an outstanding State water (Tier 2 ½) or an outstanding National Resource Water (Tier 3). As appropriate, Iowa's antidegradation policy provides Tier 2 protection (existing water quality) to the Missouri River. Tier 1 protection (existing uses) applies and the State designated beneficial uses must be protected.

1.5.2 Nebraska

The State of Nebraska has designated the following uses to the entire length of the Missouri River in Nebraska: Primary Contact Recreation, Warmwater Aquatic Life Class A, Agricultural Water Supply, and Aesthetics. It has designated the use of public drinking water supply to the river downstream of the confluence of the Niobrara River, and industrial water supply to the river downstream of the confluence of the Big Sioux River. Nebraska has not identified the Missouri River in the vicinity of the Desoto project as a National or State Resource Water. As appropriate, Nebraska's antidegradation policy provides Tier 2 protection (existing water quality) to the Missouri River. Tier 1 protection (existing uses) applies and the State designated beneficial uses must be protected.

1.6 Use of Sediment/Soil Analysis, Elutriate Testing, and Ambient Missouri River Water Quality Data for Factual Determinations

Factual Determinations regarding potential water quality impacts from the proposed hydraulic dredging to construct SWH at the proposed Desoto project was based on the analyses of representative sediment/soil samples collected from the identified excavation area at the proposed project site. The collected sediment/soil samples were also subjected to elutriate testing pursuant to the Inland Testing Manual, "Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. – Testing Manual (USEPA and USACE, 1998). Historic ambient water quality data collected along the Missouri River by the District were assessed.

2 SITE-SPECIFIC WATER QUALITY CONCERNS

2.1 Fish Consumption Advisory

The State of Nebraska had issued a fish consumption advisory for Dieldrin and PCBs on the Missouri River downstream of Gavins Point Dam. This advisory was based on the analysis of past fish tissue sampling that found levels of these substances at concentrations above the State's defined risk factor for protecting public health via fish consumption. However, the fish consumption advisory has recently been removed based on recent fish tissue sampling (NDEQ, 2012).

2.2 Section 303(d) Impaired Waters Listings

Section 303(d) of the Federal CWA requires States to evaluate water quality conditions in designated waterbodies, and list as impaired (i.e. 303(d) list) any waterbodies not meeting water quality standards. As appropriate, States must develop and implement Total Maximum Daily Loads –TMDLs (i.e. pollutant management plans) for waterbodies identified as impaired.

2.2.1 Iowa

Iowa has not listed the Missouri River in the area of the proposed Desoto project site on the State's most recent (i.e. 2010) 303(d) impaired waters list.

2.2.2 Nebraska

Nebraska's water quality standards identify the Missouri River from the Big Sioux River to the Platte River as designated Segment MT1-10000. Segment MT1-10000 is listed on Nebraska's 2012 Section 303(d) list as impaired due to a fish consumption advisory. The identified parameters of concern are Cancer Risk & Hazard Index Compounds, specifically, Dieldrin and PCBs. After the NDEQ published their 2012 Integrated Water Quality Report and Section 303(d) list on 1-April-2012 that listed Segment MT1-10000 as impaired due to the fish consumption advisory in effect, the NDEQ published the report, "Findings of the 2010 Regional Ambient Fish Tissue Program in Nebraska" in June, 2012 (NDEQ, 2012). That report indicated that Dieldrin and PCBs were no longer a fish tissue concern on Segment MT1-10000. This resulted in the fish consumption advisory for the Missouri River regarding Dieldrin and PCBs being removed. Based on the removal of the fish consumption advisory for the Missouri River, the NDEQ has indicated that the 303(d) listing of the Missouri River for Dieldrin and PCBs will be removed in the next published 303(d) listing (personal communication NDEQ). As such, the Missouri River in the area of the proposed Desoto project site will not be identified as impaired from Cancer Risk & Hazardous Index Compounds (i.e. Dieldrin and PCBs) by Nebraska's next 303(d) list of impaired waters. Personnel communication with NDEQ has indicated that elutriate testing for Dieldrin and PCBs to a detection limit of 0.4 parts-per-trillion is no longer required.

2.3 Nutrients

2.3.1 Gulf of Mexico Hypoxia

A large area of the northern Gulf of Mexico is experiencing low dissolved oxygen or hypoxia during periods in the summer off the coasts of Louisiana and Texas. The hypoxia is primarily caused by excess nutrients – originating from cities, farms, and industries in the Mississippi River Basin – which cause extensive growths of algae that deplete the oxygen in the water when they die, sink to the bottom, and decompose. The condition is exacerbated by the stratification of the water column – result of warmer, low salinity surface waters that isolate the organic-rich bottom waters from the surface and

prevent oxygen exchange with the atmosphere. Nutrient loading reduction targets of 45% of the current total nitrogen and total phosphorus riverine loads have been identified to achieve the goal for hypoxic zone size and to facilitate water quality improvements in the basin (MRGMWNTF, 2008).

The watershed of the Mississippi River drains 41 percent of the contiguous United States and includes waters from several major river systems, including the Missouri/Platte River Basin, the Ohio/Tennessee River Basin, and the Arkansas/Red/White River Basin. The Mississippi River Basin includes two functionally distinct zones, each with its own potential to contribute to Gulf hypoxia. These zones include the huge Mississippi watershed with its tributary network, and at the lower end of the river system, the deltaic zone that formerly dispersed river water naturally throughout Southeast Louisiana via a distributary (deltaic) network. While the tributaries of the Mississippi River are the sources of nutrient loading to the river trunk, the distributaries within the Mississippi Delta are critical to the final dispersal of nutrients and sediments into the Gulf of Mexico and the salinity of the estuaries and coastal waters. During the past two centuries the hydrology of the distributary zone was totally modified by the construction of flood levees, closing of key distributaries for flood control, and navigation enhancement programs. These structures isolated the river from its delta, causing an ongoing catastrophic collapse in the deltaic landscape, primarily wetlands. The hydrologic changes that have caused such damage to South Louisiana also exacerbate Gulf hypoxia by jetting most nutrient-rich river water and sediments directly into the Gulf of Mexico, bypassing the deltaic wetlands that captured the nutrients and sediments.

2.3.2 Iowa Nutrient Reduction Strategy

The 2008 Gulf Hypoxia Action Plan calls for the 12 states along the Mississippi River to develop strategies to reduce nutrient loading to the Gulf of Mexico (MRGMWNTF, 2008). In this regard, the State of Iowa has recently finalized the *"Iowa Nutrient Reduction Strategy – A science and technology-based framework to assess and reduce nutrients to Iowa waters and the Gulf of Mexico"* (IDALS et. al., 2013). The Iowa strategy follows the recommended framework provided by EPA in 2011, and is only the second state to complete a statewide nutrient reduction strategy. The Iowa Nutrient Reduction Strategy is a science and technology-based framework to assess and reduce nutrients to Iowa waters and the Gulf of Mexico. It is designed to direct efforts to reduce nutrients in surface water from both point and nonpoint sources in a scientific, reasonable and cost-effective manner. The Iowa strategy proposes a pragmatic, strategic and coordinated approach for reducing nutrient loads discharged from the state's largest wastewater treatment plants, in combination with targeted practices designed to reduce loads from nonpoint sources now while evaluating the future need for nutrient water quality standards.

For Iowa streams, EPA's recommended water quality standards' criteria range is from 0.712 to 3.26 mg/L for total N and from 0.070 to 0.118 mg/L total P (IDALS et.al., 2013). If these nutrient criteria recommendations were adopted as Iowa water quality standards, cities would be required to pay for expensive wastewater treatment plant upgrades that would address only a fraction of the overall amount of nutrients discharged to Iowa's streams while leaving wastewater treatment facilities unable to comply with permit limits (IDALS et.al., 2013). If compliance with stringent numeric effluent limits on point source discharges did not eliminate an existing impairment, the receiving stream would continue to exceed the water quality standard and would require development of a total maximum daily load (TMDL). At that point, any further reduction required by a TMDL would need to be accomplished through voluntary controls placed only on nonpoint sources. Because of the lack of confidence in EPA's recommended criteria and substantial financial costs associated with implementing nutrient removal technologies, legitimate concerns about the value of numeric nutrient criteria have been raised (IDALS, et.al., 2013). Other criteria derivation approaches such as nutrient stressor-response analysis and reference condition modeling are better alternatives that Iowa will continue assessing as a basis for appropriate nutrient standards for implementation within an adaptive watershed management framework (IDALS et.al, 2013).

2.4 National Research Council of the National Academies Assessment of Missouri River Water Quality and Sediment Management

USACE's SWH and emergent sandbar habitat (ESH) projects are directly depositing sediment into the mainstem Missouri River. Concerns have been expressed regarding the potential water quality impacts of those projects downstream and into the northern Gulf of Mexico. The following questions were tasked to the National Research Council regarding water quality and sediment management in the Missouri River:

- *What is the significance of the Missouri River sediments to the Gulf of Mexico hypoxia problem?*
- *What are the key environmental and economic considerations regarding nutrient loads and/or contaminants in Missouri River sediment? To what extent can such issues be addressed with management strategies?*

The following discussion and conclusions are taken from the document, "Missouri River Planning – Recognizing and Incorporating Sediment Management" prepared by the National Research Council (NRC, 2011).

Excess nitrogen loads are responsible for the long-term increase in the hypoxic area in the northern Gulf of Mexico; however, recent studies suggest that phosphorus may also be contributing to hypoxia, especially near the mouths of the Mississippi and Atchafalaya Rivers during the spring. The USACE's construction of SWH projects will result in releases of both nitrogen and phosphorus to the Missouri River because much of the topsoil portion of the sediment disposed of in the river has been heavily fertilized.

The National Research Council further assessed the situation based on total nitrogen (TN) and total phosphorus (TP) levels representative of excavated sediment/soil at SWH project sites and current TN and TP loads in the Missouri River and delivered to the Gulf of Mexico. It was concluded that the TN loads from constructed SWH projects will be insignificant compared to the current TN loads transported in the Missouri River and to the Gulf. Phosphorus loadings to the Missouri River from these projects, however, are likely to constitute a much greater fraction of the current load than additional nitrogen loadings. An upper-bound estimate of the increase in TP loadings to the Gulf of Mexico as a result of all potential SWH projects is a 6 to 12 percent increase. This estimate represents an upper bound assuming all sediment is delivered to the Gulf. In reality, sediment deposition processes in the Missouri and lower Mississippi river channels would reduce loads delivered downstream and eventually to the Gulf of Mexico. A comparison of potential phosphorus loads from USACE's SWH projects, with load increments required to produce measurable changes in the areal extent of Gulf hypoxia, showed these projects will not significantly change the extent of the hypoxic area in the Gulf of Mexico.

3 SAMPLING AND ANALYSIS METHODS

Sediment/soil samples, representative of the areas to be excavated for SWH construction at the proposed Desoto project site, were collected, analyzed, and subjected to elutriate testing. The results were used to assess the potential water quality impacts that the discharge from hydraulic dredging at the proposed project site would have on the Missouri River. Sediment/soil sampling occurred in May 2013.

3.1 Quality Control Plan

A Quality Control Plan (QCP) was developed to conduct elutriate testing of sediment/soil samples collected at the Desoto project site. The QCP was developed in consultation with the IDNR and NDEQ and is included as Attachment 1. The parameters that were measured in the field and analyzed in

the laboratory for the collected sediment/soil samples and prepared samples for elutriate testing are listed in Table 1. Analytical methods are provided in the QCP (Attachment 1).

Table 1. Parameters measured and analyzed for the different media assessed as part of the sediment/soil sampling and elutriate testing conducted at the Desoto project site.

Parameter	Soil All Analysis	Soil Nutrient Analysis	Receiving Water	Pre-Elutriate Water	Elutriate Water	
					Non-Filtered	Filtered
FIELD MEASUREMENTS						
Water Temperature (°C)			X			
Dissolved Oxygen (mg/L and % Sat)			X			
pH (S.U.)			X			
Specific Conductance (µS/cm)			X			
Turbidity			X			
PHYSICAL AND AGGREGATE PROPERTIES						
Particle Size	X	X				
pH	X	X				X
Total Suspended Solids			X	X	X	
Turbidity				X	X	
NUTRIENTS						
Nitrogen, Ammonia as N	X	X	X	(Note 1)	X	X
Nitrogen, Nitrate/Nitrite as N)	X	X	X	X		X
Nitrogen, Total Kjeldahl as N	X	X	X	X	X	
Phosphorus, Dissolved			X			X
Phosphorus, Orthophosphate			X			X
Phosphorus, Total	X	X	X	X	X	
AGGREGATE ORGANIC CONSTITUENTS						
CBOD			X	X	X	
Chemical Oxygen Demand			X	X	X	
Organic Carbon, Total	X	X	X	X	X	
METALS (Dissolved)						
Dissolved Metals Scan			X			X
METALS (Total)						
Total Metals Scan			X	X	X	
Arsenic, Total	X					
Cadmium, Total	X					
Chromium, Total	X					
Copper, Total	X					
Lead, Total	X					
Mercury, Total	X					
Nickel, Total	X					
Zinc Total	X					
PESTICIDES and PCBs						
Atrazine	X		X		X	
Organochlorine Pesticide/PCB Scan	X		X		X	

(Note 1): Ammonia was not analyzed in pre-elutriate samples due to method limitation and interference.

3.2 Collection of Sediment/Soil Samples

Sediment/soil samples were collected at five sites at the proposed Desoto project site on 17-May-2013 (Figure 2). The five locations where the sediment/soil samples were collected are shown in Figure 2 and described in Table 2 and Table 3. The sediment samples at each of the five sites were collected with a gas-powered auger equipped with a 2-in diameter stainless steel coring bit. Core samples were collected to a depth of 4 feet and composited, and 1-gallon of the composited sediment/soil material was collected and transported to the laboratory for analysis. Soil analysis and full elutriate testing was done on sediment/soil samples collected at sites DO-E1 and DO-E2. Soil analysis and pre-elutriate testing was done on sediment/soil samples collected at sites DO-N1, DO-N2, and DO-N3.

Table 2. Sediment/soil samples collected at the proposed Desoto shallow-water habitat project site for analysis and elutriate testing.

Sample Type	Sample ID	Sample Date	Sampled Depth	Sampling Method
Sediment/Soil	DO-E1	17-May-2013	0 - 4 feet	Composite Core
Sediment/Soil	DO-E2	17-May-2013	0 - 4 feet	Composite Core
Sediment/Soil	DO-N1	17-May-2013	0 - 4 feet	Composite Core
Sediment/Soil	DO-N2	17-May-2013	0 - 4 feet	Composite Core
Sediment/Soil	DO-N3	17-May-2013	0 - 4 feet	Composite Core

Table 3. Geo-referenced locations where sediment/soil samples were collected at the proposed Desoto shallow-water habitat project site.

Site	Latitude	Longitude
DO-E1	41° 30’ 43.4”	96° 02’ 42.8”
DO-E2	41° 30’ 43.2”	96° 02’ 57.7”
DO-N1	41° 30’ 44.4”	96° 02’ 35.8”
DO-N2	41° 30’ 44.2”	96° 03’ 50.9”
DO-N3	41° 30’ 44.8”	96° 03’ 01.0”

Note: GPS device used for determining locations was Garmin Map 76.

3.3 Collection of Receiving Water

In accordance with the “*Inland Testing Manual*”, receiving water was collected from the Missouri River for elutriate testing. Receiving water measurements and samples were collected from the Missouri River at site DO-RW at the Wilson Island boat ramp (Figure 2). The mean daily flow of the Missouri River when receiving water samples were collected on 17-May-2013 was 26,200 cfs at the nearest USGS gauge approximately 25 miles downstream at Omaha, NE (USGS gauge 06610000).

3.4 Elutriate Testing

The process that was used to prepare samples for elutriate testing from the sediment/soil samples collected at the proposed Desoto project site is depicted in Figure 3.

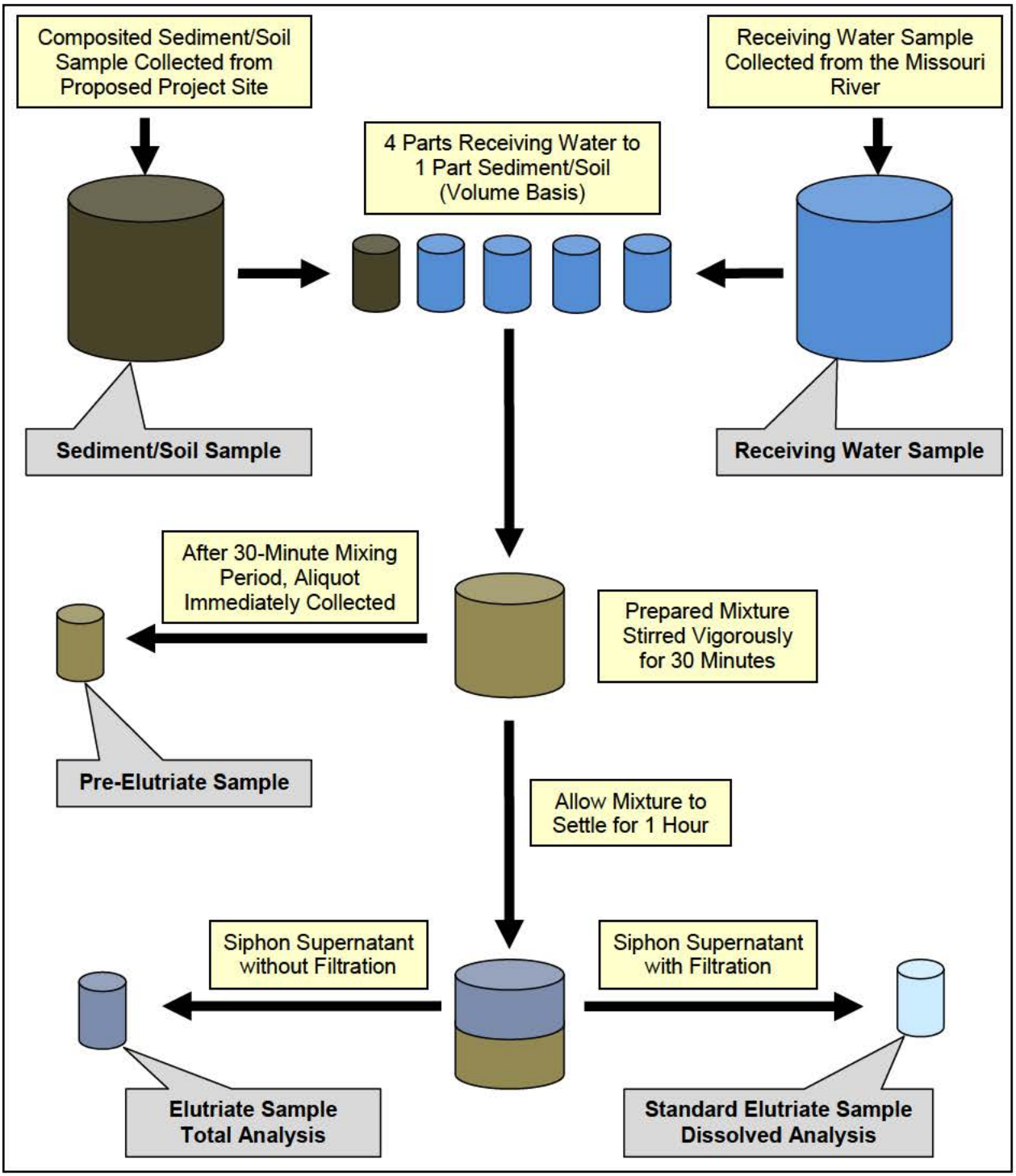

Figure 3. Process used to prepare samples for elutriate testing from sediment/soil samples collected at the Desoto project site.

3.4.1 Elutriate Samples

Elutriate samples were prepared in accordance with the "*Inland Testing Manual*", and were prepared by using receiving water collected from the Missouri River at site DO-RW. The samples were prepared in the laboratory by sub-sampling 1-liter of the collected sediment/soil sample from the well-mixed original sample. The sediment material and unfiltered receiving water were then combined in a sediment-to-water ratio of 1:4 on a volume basis at room temperature (22 ± 2°C). The 1:4 sediment-to-water ratio is believed to represent "end-of-pipe" discharge conditions for hydraulic dredging. After the correct ratio was achieved, the mixture was stirred vigorously for 30 minutes with a mechanical stirrer/shaker. After the 30-minute mixing period, the mixture is allowed to settle for one hour. The supernatant was then siphoned off without disturbing the settled material. Analysis for total constituents was done on the supernatant without filtration, and the supernatant was filtered through a 0.45-micron filter for analysis of dissolved constituents. The filtered water is the standard elutriate sample identified by the *"Inland Testing Manual"* and represents the dissolved constituents that could be released from dredged material during the hydraulic dredging process.

3.4.2 Pre-Elutriate Samples

Prepared pre-elutriate samples were analyzed. The pre-elutriate samples were prepared the same as standard elutriate samples through the point of the 30-minute mixing period. At that time an aliquot of water was immediately drawn off the mixed solution and identified as the pre-elutriate sample. The pre-elutriate sample was analyzed for the following constituents: Total Kjeldahl Nitrogen, Total Nitrate-Nitrite Nitrogen, Total Phosphorus, Total Organic Carbon, Total Metals Scan, Total Suspended Solids, Turbidity, and pH. The pre-elutriate sample is believed to represent conditions of the "end-of-pipe" hydraulic dredging discharge slurry prior to any mixing with the receiving water (i.e. Missouri River).

3.4.3 Metal Analysis

The metals Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, and Zinc were identified as parameters of concern by the State of Nebraska. Collected sediment/soil samples were directly analyzed for these metals. Total and dissolved metals scans were run on the collected receiving water and appropriately run on the prepared elutriate samples. Many of Iowa and Nebraska's water quality standards for metals are hardness based. The District has monitored ambient water quality conditions of the Missouri River at Omaha, NE (RM619) over the 10-year period 2003 through 2012. Based on 31 quarterly measurements, hardness (mg/L) in the Missouri River ranged from 231 to 379, averaged 277, and had a median of 271. The hardness of the receiving water sample collected on 17-May-2013 was 340 mg/L.

4 RESULTS

4.1 Receiving Water Field Measurements

The receiving water used for the elutriate testing was collected from the Missouri River at site DO-RW. Water quality conditions of the receiving water measured in the field on 17-May-2013 at the time of collection were: Water Temperature, 20.0°C; Dissolved Oxygen, 6.9 mg/l and 77.8% saturation; pH, 8.5 S.U.; Specific Conductance, 784 µS/cm; and Turbidity, 1,175 NTU.

4.2 Particle Size Analysis

The collected sediment/soil samples used for elutriate testing were analyzed for particle size using Method ASTM D422. The Particle Size Distribution Reports for the analyzed sediment/soil

samples collected at sites DO-E1, DO-E2, DO-N1, DO-N2, and DO-N3 are provided in Attachment 2. Table 4 and Figure 4 summarize the particle size percent composition of the collected sediment/soil samples. The collected sediment/soil samples ranged from 56.3% to 88.5% fines and from 11.5% to 43.7% sand. None of the collected sediment/soil samples contained material of a grain size greater than sand (Table 4).

Table 4. Summary of particle size analysis of the sediment/soil samples collected at the proposed Desoto project site.

Sample ID	% Cobbles	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
DO-E1	0.0	0.0	0.0	0.0	0.1	20.1	53.1	26.7
DO-E2	0.0	0.0	0.0	0.0	0.1	38.4	44.4	17.1
DO-N1	0.0	0.0	0.0	0.0	0.2	21.7	56.6	21.5
DO-N2	0.0	0.0	0.0	0.0	0.1	11.4	59.8	28.7
DO-N3	0.0	0.0	0.0	0.0	0.3	43.4	36.2	20.1
MEAN	**0.0**	**0.0**	**0.0**	**0.0**	**0.2**	**27.0**	**50.0**	**22.8**

See Attachment 2 for defination of particle sizes.

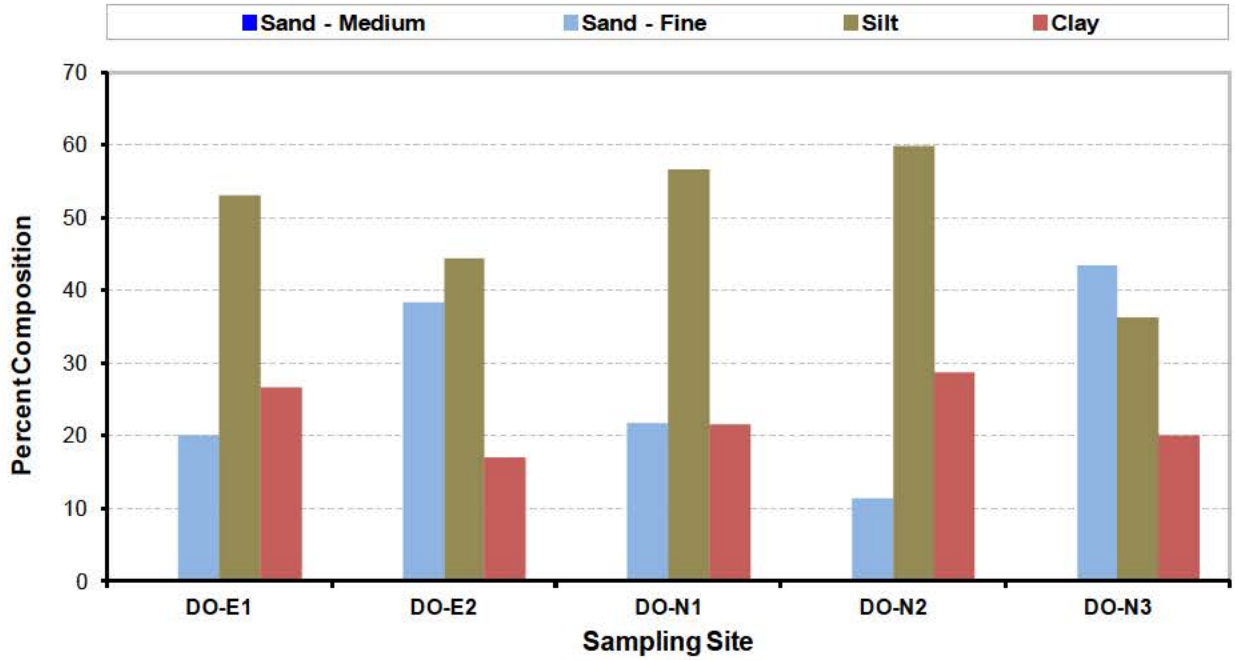

Figure 4. Particle size percent composition of sediment/soil samples collected at sites DO-E1, DOI-E2, DO-N1, DO-N2, and DO-N3.

4.3 Physiochemical Analysis of Sediment/Soil and Receiving Water Samples and Elutriate Testing Results

The laboratory reports of the analyses of the sediment/soil, receiving water, pre-elutriate, and elutriate samples are provided in Attachment 3. The following summarizes these results and their application to Iowa and Nebraska water quality standards.

4.3.1 Analyzed Constituents with Promulgated State Water Quality Standards

The following constituents were analyzed and have water quality standards criteria promulgated by the States of Iowa and Nebraska:

- Ammonia Nitrogen
- Atrazine
- Metals
  - Aluminum
  - Antimony
  - Arsenic
  - Beryllium
  - Cadmium
  - Chromium III
  - Copper
  - Iron
  - Lead
  - Manganese
  - Mercury
  - Nickel
  - Selenium
  - Silver
  - Thallium
  - Zinc
- Nitrate-Nitrite Nitrogen
- Organochlorine Pesticides (Scan)
- Polychlorinated Biphenyls – PCBs (Scan)
- pH

4.3.1.1 *Ammonia Nitrogen*

Constituent: Ammonia Nitrogen						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil (mg/kg)	Total (mg/L)	Dissolved (mg/L)	Total (mg/L)	Non-Filtered Total Analysis (mg/L)	Filtered Dissolved Analysis (mg/L)
DO-E1	0.7	0.22			0.11	0.10
DO-E2	2.7	0.22			0.29	0.30
DO-N1	0.6	0.22				
DO-N2	0.9	0.22				
DO-N3	0.7	0.22				
MEAN	**1.12**	**-----**			**0.20**	**0.20**

For application of water quality standards criteria for Ammonia, period of record (2003 - 2012) median pH and temperature of the Missouri River are, respectively, 8.25 S.U and 20.9°C.

Iowa Water Quality Standards – Ammonia as N; Use Class B(WW-1)

Constituent	Acute Standard	Chronic Standard
Ammonia (Total as N) *Early Life Stages Present* *pH = 8.25, Temperature (℃) = 20.9*	5.2 mg/L	1.1 mg/L

Nebraska Water Quality Standards – Ammonia as N; Warmwater Aquatic Life Class A

Constituent	Acute Standard	Chronic Standard
Ammonia (Total as N) *Early Life Stages Present* *pH = 8.25, Temperature (℃) = 20.9*	5.2 mg/L	1.1 mg/L

Comparison of Ammonia Elutriate Tests to Water Quality Standards

Both the Iowa and Nebraska acute and chronic ammonia criteria for the Missouri River are the same based on the ambient water quality conditions of the Missouri River. All non-filtered and filtered elutriate tests of the 2 collected sediment/soil samples at the proposed Desoto project site were less than the Iowa and Nebraska acute and chronic criteria for ammonia. The highest elutriate test for total ammonia was 0.30 mg/L.

4.3.1.2 *Atrazine*

Constituent: Atrazine						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil (mg/kg)	Total (µg/L)	Dissolved (µg/L)	Total (µg/L)	Non-Filtered Total Analysis (µg/L)	Filtered Dissolved Analysis (µg/L)
DO-E1	<0.002	1.35			0.72	
DO-E2	<0.002	1.35			0.87	
MEAN	**<0.002**	**-----**			**0.80**	

Iowa Water Quality Standards – Atrazine; Use Class B(WW-1) and Human Health – Fish Consumption

Constituent	Acute Standard	Chronic Standard	Human Health Standard
Atrazine	-----	-----	-----

Nebraska Water Quality Standards – Atrazine; Warmwater Aquatic Life Class A and Public Drinking Water

Constituent	Acute Standard	Chronic Standard	Public Drinking Water Standard
Atrazine	330 µg/L	12 µg/L	3 µg/L

Comparison of Atrazine Elutriate Tests to Water Quality Standards

All non-filtered elutriate tests of the collected sediment/soil samples at the proposed Desoto project site were less than the Nebraska acute, chronic, and public drinking water criteria for Atrazine.

4.3.1.3 *Metals – Aluminum*

Constituent: Metals - Aluminum						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil (mg/kg)	Total (µg/L)	Dissolved (µg/L)	Total (µg/L)	Non-Filtered Total Analysis (µg/L)	Filtered Dissolved Analysis (µg/L)
DO-E1		27,900	140	1,344,000	23,380	<30
DO-E2		27,900	140	1,323,000	7,920	<30
DO-N1		27,900	140	1,413,000		
DO-N2		27,900	140	1,151,000		
DO-N3		27,900	140	1,159,000		
MEAN		-----	-----	**1,278,000**	**15,650**	**<30**

Iowa Water Quality Standards – Aluminum; Use Class B(WW-1), Human Health – Fish Consumption

Constituent	Acute Standard (Total Recoverable)	Chronic Standard (Total Recoverable)	Human Health Standard
Aluminum	750 µg/L	87 µg/L	-----

Nebraska Water Quality Standards – Aluminum; Warmwater Aquatic Life Class A and Public Drinking Water

Constituent	Acute Standard (Dissolved)	Chronic Standard (Dissolved)	Public Drinking Water Secondary Standard
Aluminum	750 µg/L	87 µg/L	200 µg/L

Comparison of Aluminum Elutriate Tests to Water Quality Standards

Iowa's Aluminum criteria are expressed as Total Recoverable which was not directly measured in the analyses – dissolved elutriate analyses were compared to Iowa's acute and chronic water quality standards. EPA guidance indicates the dissolved concentration of most metals indicates the bio-available form that can adversely impact aquatic life. Nebraska's Aquatic Life (acute and chronic) Aluminum criteria are expressed as dissolved. The filtered elutriate tests for Aluminum were all below detection (<30 µg/L) and were below Iowa's and Nebraska's acute and chronic standards. The total Aluminum concentration (27,900 µg/L) of the collected receiving water from the Missouri River was above Nebraska's 200 µg/L secondary Public Drinking Water standard. However, Nebraska's water quality standards qualify the application of numerical criteria for public drinking water as follows:

> *"If the natural background level of a parameter is greater than the numerical standard, this shall not in and of itself prohibit the use of the surface water. If the natural background level of a parameter is greater than the numerical standard listed below, the background level shall be used in place of the numerical criteria."*

The non-filtered elutriate results for Aluminum were less than the levels measured in the collected receiving water.

The elevated Aluminum levels in the pre-elutriate samples are problematic for Nebraska's Public Drinking Water use. However, the Nebraska water quality standards state that Public Drinking Water use is for surface waters which serve as a public drinking water supply. These waters must be treated (e.g., coagulation, sedimentation, filtration, chlorination) before the water is suitable for human consumption. After treatment, these waters are suitable for drinking water, food processing, and similar uses. As indicated by the filtered elutriate testing, Aluminum levels (dissolved) are at or below the 200 μg/L Public Drinking Water standard after settling and filtration. Also, the NDEQ allows for mixing zones in assessing compliance with Nebraska Drinking Water Supply water quality standards. As stated in the Nebraska's water quality standards (Chapter 2, 010.08A), mixing zones for public drinking water criteria shall be designed to not extend to within a 2-mile zone of influence from any public drinking water supply intake – i.e. a discharge with an approved mixing zone must not cause Public Drinking Water standards to be exceeded at a point 2 miles upstream of a public drinking water intake. Significant dilution of the dredging discharge will immediately occur upon mixing with the Missouri River. There are no drinking water intakes in the immediate vicinity of the proposed dredging discharge at the Desoto project site. The nearest downstream public drinking water intakes, Omaha, NE and Council Bluffs, IA, are approximately 20 miles downstream.

4.3.1.4 *Metals – Antimony*

Constituent: Metals - Antimony						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil (mg/kg)	Total (µg/L)	Dissolved (µg/L)	Total (µg/L)	Non-Filtered Total Analysis (µg/L)	Filtered Dissolved Analysis (µg/L)
DO-E1		1	0.05J	3.3	0.7	<0.03
DO-E2		1	0.05J	2.9	0.9	0.2J
DO-N1		1	0.05J	3.8		
DO-N2		1	0.05J	4.1		
DO-N3		1	0.05J	3.9		
MEAN		**-----**	**-----**	**3.6**	**0.8**	**0.1J**

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

Iowa Water Quality Standards – Antimony; Use Class B(WW-1), Human Health – Fish Consumption

Constituent	Acute Standard	Chronic Standard	Human Health Standard (Total Recoverable)
Antimony	-----	-----	640 µg/L

Nebraska Water Quality Standards – Antimony; Warmwater Aquatic Life Class A and Public Drinking Water

Constituent	Acute Standard (Dissolved)	Chronic Standard (Dissolved)	Public Drinking Water Standard
Antimony	88 µg/L	30 µg/L	5.6 µg/L

Comparison of Antimony Elutriate Tests to Water Quality Standards

The filtered elutriate tests (dissolved concentrations) for Antimony were all below Nebraska's acute and chronic Warmwater Aquatic Life water quality standards. Pre-elutriate and non-filtered elutriate tests (total concentrations) were below Iowa's Human Health and Nebraska's Public Drinking Water standard.

4.3.1.5 Metals – Arsenic

Constituent: Metals - Arsenic						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil (mg/kg)	Total (µg/L)	Dissolved (µg/L)	Total (µg/L)	Non-Filtered Total Analysis (µg/L)	Filtered Dissolved Analysis (µg/L)
DO-E1	7.8	20	3	901	14	2
DO-E2	7.7	20	3	791	5	2
DO-N1		20	3	965		
DO-N2		20	3	1,120		
DO-N3		20	3	779		
MEAN	**7.75**	**-----**	**-----**	**911**	**9.5**	**2**

Iowa Water Quality Standards – Arsenic; Use Class B(WW-1), Human Health – Fish Consumption

Constituent	Acute Standard	Chronic Standard	Human Health Standard
Arsenic	(Inorganic Form Only)	(Inorganic Form Only)	(Inorganic Form Only)

Nebraska Water Quality Standards – Arsenic; Warmwater Aquatic Life Class A and Public Drinking Water

Constituent	Acute Standard (Dissolved)	Chronic Standard (Dissolved)	Public Drinking Water Standard
Arsenic	340 µg/L	16.7 µg/L	10 µg/L

Comparison of Arsenic Elutriate Tests to Water Quality Standards

The filtered elutriate tests (dissolved) for Arsenic were below Nebraska's acute and chronic criteria for Warmwater Aquatic Life Class A. The mean of the non-filtered elutriate tests (total) for Arsenic were below Nebraska's Public Drinking Water standard.

Reflective of the Arsenic levels analyzed in the sediment/soil samples, the pre-elutriate samples for total Arsenic were elevated. This could be problematic regarding Nebraska's Public Drinking Water standard. However, the Nebraska water quality standards state that Public Drinking Water use is for surface waters which serve as a public drinking water supply. These waters must be treated (e.g., coagulation, sedimentation, filtration, chlorination) before the water is suitable for human consumption. After treatment, these waters are suitable for drinking water, food processing, and similar uses. As indicated by elutriate testing, Arsenic levels are below the 10 µg/L Public Drinking Water standard after settling and filtration. Also, the NDEQ allows for mixing zones in assessing compliance with Nebraska Drinking Water Supply water quality standards. As stated in the Nebraska's water quality standards (Chapter 2, 010.08A), mixing zones for public drinking water criteria shall be designed to not extend to within a 2-mile zone of influence from any public drinking water supply intake – i.e. a discharge with an approved mixing zone must not cause Public Drinking Water standards to be exceeded at a point 2 miles upstream of a public drinking water intake. Significant dilution of the dredging discharge will immediately occur upon mixing with the Missouri River. There are no drinking water intakes in the immediate vicinity of the proposed dredging discharge at the Desoto project site. The nearest downstream public drinking water intakes, Omaha, NE and Council Bluffs, IA, are approximately 20 miles downstream.

4.3.1.6 *Metals – Beryllium*

Constituent: Metals - Beryllium						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil (mg/kg)	Total (µg/L)	Dissolved (µg/L)	Total (µg/L)	Non-Filtered Total Analysis (µg/L)	Filtered Dissolved Analysis (µg/L)
DO-E1		0.9J	<0.4	58	0.7J	1J
DO-E2		0.9J	<0.4	60	0.2J	1J
DO-N1		0.9J	<0.4	63		
DO-N2		0.9J	<0.4	53		
DO-N3		0.9J	<0.4	53		
MEAN		**-----**	**-----**	**57**	**0.45J**	**1J**

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

Iowa Water Quality Standards – Beryllium; Use Class B(WW-1), Human Health – Fish Consumption

Constituent	Acute Standard	Chronic Standard	Human Health Standard
Beryllium	-----	-----	-----

Nebraska Water Quality Standards – Beryllium; Warmwater Aquatic Life Class A and Public Drinking Water

Constituent	Acute Standard (Dissolved)	Chronic Standard (Dissolved)	Public Drinking Water Standard
Beryllium	130 µg/L	5.3 µg/L	4 µg/L

Comparison of Beryllium Elutriate Tests to Water Quality Standards

The filtered elutriate tests for Beryllium were all below Nebraska's acute and chronic criteria for Warmwater Aquatic Life Class A. The non-filtered elutriate tests for Beryllium were also below Nebraska's Public Drinking Water standard.

The pre-elutriate samples for total Beryllium were elevated. This could be problematic regarding Nebraska's Public Drinking Water standard. However, the Nebraska water quality standards state that Public Drinking Water use is for surface waters which serve as a public drinking water supply. These waters must be treated (e.g., coagulation, sedimentation, filtration, chlorination) before the water is suitable for human consumption. After treatment, these waters are suitable for drinking water, food processing, and similar uses. As indicated by elutriate testing, Beryllium levels are below the 4 µg/L Public Drinking Water standard after settling and filtration. Also, the NDEQ allows for mixing zones in assessing compliance with Nebraska Drinking Water Supply water quality standards. As stated in the Nebraska's water quality standards (Chapter 2, 010.08A), mixing zones for public drinking water criteria shall be designed to not extend to within a 2-mile zone of influence from any public drinking water supply intake – i.e. a discharge with an approved mixing zone must not cause Public Drinking Water standards to be exceeded at a point 2 miles upstream of a public drinking water intake. Significant dilution of the dredging discharge will immediately occur upon mixing with the Missouri River. There are no drinking water intakes in the immediate vicinity of the proposed dredging discharge at the Desoto project site. The nearest downstream public drinking water intakes, Omaha, NE and Council Bluffs, IA, are approximately 20 miles downstream.

4.3.1.7 *Metals – Cadmium*

Constituent: Metals - Cadmium						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil (mg/kg)	Total (µg/L)	Dissolved (µg/L)	Total (µg/L)	Non-Filtered Total Analysis (µg/L)	Filtered Dissolved Analysis (µg/L)
DO-E1	0.70	1.1	1.1	59.3	0.6	0.5
DO-E2	0.52	1.1	1.1	58.2	0.2J	0.6
DO-N1		1.1	1.1	57.8		
DO-N2		1.1	1.1	52.5		
DO-N3		1.1	1.1	59.2		
MEAN	**0.61**	**-----**	**-----**	**57.4**	**0.4J**	**0.55J**

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

Iowa Water Quality Standards – Cadmium; Use Class B(WW-1), Human Health – Fish Consumption

Constituent	Acute Standard	Chronic Standard	Human Health Standard
Cadmium *Hardness = 277mg/L*	6.0 µg/L	0.6 µg/L	168 µg/L

Nebraska Water Quality Standards – Cadmium; Warmwater Aquatic Life Class A and Public Drinking Water

Constituent	Acute Standard (Dissolved)	Chronic Standard (Dissolved)	Public Drinking Water Standard
Cadmium *Hardness = 277 mg/L*	15.9 µg/L	0.50 µg/L	5 µg/L

Comparison of Cadmium Elutriate Tests to Water Quality Standards

Iowa's Cadmium criteria are expressed as Total Recoverable which was not directly measured in the analyses – dissolved elutriate analyses were compared to Iowa's acute and chronic water quality standards. EPA guidance indicates the dissolved concentration of most metals indicates the bio-available form that can adversely impact aquatic life. Nebraska's Aquatic Life (acute and chronic) Cadmium criteria are expressed as dissolved. The filtered elutriate tests for Cadmium were below Iowa's and Nebraska's acute standards, and at or below both State's chronic standard for warmwater aquatic life protection.

Reflective of the Cadmium levels measured in the sediment/soil samples, the pre-elutriate samples for total Cadmium were elevated. This could be problematic regarding Nebraska's Public Drinking Water standard. However, the Nebraska water quality standards state that Public Drinking Water use is for surface waters which serve as a public drinking water supply. These waters must be treated (e.g., coagulation, sedimentation, filtration, chlorination) before the water is suitable for human consumption. After treatment, these waters are suitable for drinking water, food processing, and similar uses. As indicated by elutriate testing, Cadmium levels are below the 5 µg/L Public Drinking Water standard after settling and filtration. Also, the NDEQ allows for mixing zones in assessing compliance with Nebraska

Drinking Water Supply water quality standards. As stated in the Nebraska's water quality standards (Chapter 2, 010.08A), mixing zones for public drinking water criteria shall be designed to not extend to within a 2-mile zone of influence from any public drinking water supply intake – i.e. a discharge with an approved mixing zone must not cause Public Drinking Water standards to be exceeded at a point 2 miles upstream of a public drinking water intake. Significant dilution of the dredging discharge will immediately occur upon mixing with the Missouri River. There are no drinking water intakes in the immediate vicinity of the proposed dredging discharge at the Desoto project site. The nearest downstream public drinking water intakes, Omaha, NE and Council Bluffs, IA, are approximately 20 miles downstream.

4.3.1.8 *Metals – Chromium III*

Constituent: Metals – Chromium III						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil (mg/kg)	Total (µg/L)	Dissolved (µg/L)	Total (µg/L)	Non-Filtered Total Analysis (µg/L)	Filtered Dissolved Analysis (µg/L)
DO-E1	18.8	30	<2	1,690	30	3J
DO-E2	17.8	30	<2	1,710	9J	5J
DO-N1		30	<2	1,840		
DO-N2		30	<2	1,540		
DO-N3		30	<2	1,560		
MEAN		**-----**	**-----**	**1,668**	**20J**	**4J**

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

Iowa Water Quality Standards – Chromium III; Use Class B(WW-1), Human Health – Fish Consumption

Constituent	Acute Standard	Chronic Standard	Human Health Standard
Chromium III	-----	-----	-----

Nebraska Water Quality Standards – Chromium III; Warmwater Aquatic Life Class A and Public Drinking Water

Constituent	Acute Standard (Dissolved)	Chronic Standard (Dissolved)	Public Drinking Water Standard
Chromium III *Hardness = 277 mg/L*	1,364 µg/L	178 µg/L	100 µg/L

Comparison of Chromium III Elutriate Tests to Water Quality Standards

The filtered elutriate tests for Chromium were below Nebraska's acute and chronic criteria for Warmwater Aquatic Life Class A. The non-filtered elutriate tests for Chromium were also below Nebraska's Public Drinking Water standard.

Reflective of the Chromium levels measured in the sediment/soil samples, the pre-elutriate samples for total Chromium were elevated. This could be problematic regarding Nebraska's Public Drinking Water standard. However, the Nebraska water quality standards state that Public Drinking Water use is for surface waters which serve as a public drinking water supply. These waters must be treated (e.g., coagulation, sedimentation, filtration, chlorination) before the water is suitable for human consumption. After treatment, these waters are suitable for drinking water, food processing, and similar uses. As indicated by elutriate testing, Chromium levels are below the 100 µg/L Public Drinking Water standard after settling and filtration. Also, the NDEQ allows for mixing zones in assessing compliance with Nebraska Drinking Water Supply water quality standards. As stated in the Nebraska's water quality standards (Chapter 2, 010.08A), mixing zones for public drinking water criteria shall be designed to not extend to within a 2-mile zone of influence from any public drinking water supply intake – i.e. a discharge with an approved mixing zone must not cause Public Drinking Water standards to be exceeded at a point 2 miles upstream of a public drinking water intake. Significant dilution of the dredging discharge will immediately occur upon mixing with the Missouri River. There are no drinking water intakes in the immediate vicinity of the proposed dredging discharge at the Desoto project site. The nearest downstream public drinking water intakes, Omaha, NE and Council Bluffs, IA, are approximately 20 miles downstream.

4.3.1.9 *Metals – Copper*

Constituent: Metals – Copper						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil (mg/kg)	Total (µg/L)	Dissolved (µg/L)	Total (µg/L)	Non-Filtered Total Analysis (µg/L)	Filtered Dissolved Analysis (µg/L)
DO-E1	16.8	40	10	1,760	30	20J
DO-E2	15.9	40	10	2,020	10	20J
DO-N1		40	10	1,970		
DO-N2		40	10	1,820		
DO-N3		40	10	1,710		
MEAN		**-----**	**-----**	**1,856**	**20**	**20J**

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

Iowa Water Quality Standards – Copper; Use Class B(WW-1), Human Health – Fish Consumption

Constituent	Acute Standard	Chronic Standard	Human Health Standard
Copper *Hardness = 277 mg/L*	37 µg/L	22 µg/L	1,000 µg/L

Nebraska Water Quality Standards – Copper; Warmwater Aquatic Life Class A and Public Drinking Water

Constituent	Acute Standard (Dissolved)	Chronic Standard (Dissolved)	Public Drinking Water Standard (Secondary)
Copper *Hardness = 277 mg/L*	35 µg/L	21 µg/L	1,000 µg/L

Comparison of Copper Elutriate Tests to Water Quality Standards

Iowa's Copper criteria are expressed as Total Recoverable which was not directly measured in the analyses – dissolved elutriate analyses were compared to Iowa's acute and chronic water quality standards. EPA guidance indicates the dissolved concentration of most metals indicates the bio-available form that can adversely impact aquatic life. Nebraska's Aquatic Life (acute and chronic) Copper criteria are expressed as dissolved. The filtered elutriate tests for Copper were all below Iowa's and Nebraska's acute and chronic standard for warmwater aquatic life protection.

Reflective of the Copper levels measured in the sediment/soil samples, the pre-elutriate samples for total Copper were elevated. This could be problematic regarding Iowa's Human Health and Nebraska's Public Drinking Water standards. Nebraska water quality standards state that Public Drinking Water use is for surface waters which serve as a public drinking water supply. These waters must be treated (e.g., coagulation, sedimentation, filtration, chlorination) before the water is suitable for human consumption. After treatment, these waters are suitable for drinking water, food processing, and similar uses. As indicated by elutriate testing, Copper levels are below the 1,000 µg/L Public Drinking Water standard after settling and filtration. Also, the NDEQ allows for mixing zones in assessing compliance with Nebraska Drinking Water Supply water quality standards. As stated in the Nebraska's water quality

standards (Chapter 2, 010.08A), mixing zones for public drinking water criteria shall be designed to not extend to within a 2-mile zone of influence from any public drinking water supply intake – i.e. a discharge with an approved mixing zone must not cause Public Drinking Water standards to be exceeded at a point 2 miles upstream of a public drinking water intake. Iowa's Human Health standard is in regards to risk associated with fish consumption. Bio-accumulation of Copper in fish is highly dependent upon the bio-availability of the metal to fish which is largely dependent upon dissolved concentrations of Copper. Significant dilution of the dredging discharge will immediately occur upon mixing with the Missouri River. There are no drinking water intakes in the immediate vicinity of the proposed dredging discharge at the Desoto project site. The nearest downstream public drinking water intakes, Omaha, NE and Council Bluffs, IA, are approximately 20 miles downstream.

4.3.1.10 Metals – Iron

Constituent: Metals - Iron						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil (mg/kg)	Total (μg/L)	Dissolved (μg/L)	Total (μg/L)	Non-Filtered Total Analysis (μg/L)	Filtered Dissolved Analysis (μg/L)
DO-E1		34,680	140	2,007,000	25,970	20J
DO-E2		34,680	140	2,065,000	7,280	20J
DO-N1		34,680	140	2,224,000		
DO-N2		34,680	140	1,922,000		
DO-N3		34,680	140	1,886,000		
MEAN		-----	-----	**2,020,800**	**16,625**	**20J**

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

Iowa Water Quality Standards – Iron; Use Class B(WW-1), Human Health – Fish Consumption

Constituent	Acute Standard	Chronic Standard	Human Health Standard
Iron	-----	-----	-----

Nebraska Water Quality Standards – Iron; Warmwater Aquatic Life Class A and Public Drinking Water

Constituent	Acute Standard (Dissolved)	Chronic Standard (Dissolved)	Public Drinking Water Standard (Secondary)
Iron	-----	1,000 μg/L	300 μg/L

Comparison of Iron Elutriate Tests to Water Quality Standards

The filtered elutriate tests for Iron were all below Nebraska's chronic standard. The total Iron concentration (34,680 μg/L) of the collected receiving water from the Missouri River was above Nebraska's 300 μg/L secondary Public Drinking Water standard. However, Nebraska's water quality standards qualify the application of numerical criteria for public drinking water as follows:

> *"If the natural background level of a parameter is greater than the numerical standard, this shall not in and of itself prohibit the use of the surface water. If the natural background level of a parameter is greater than the numerical standard listed below, the background level shall be used in place of the numerical criteria."*

The non-filtered elutriate test results for Iron were less than the Iron level present in the collected receiving water.

The elevated Iron levels in the pre-elutriate samples are problematic for Nebraska's secondary Public Drinking Water use. However, the Nebraska water quality standards state that Public Drinking Water use is for surface waters which serve as a public drinking water supply. These waters must be treated (e.g., coagulation, sedimentation, filtration, chlorination) before the water is suitable for human consumption. After treatment, these waters are suitable for drinking water, food processing, and similar uses. As indicated by the filtered elutriate testing, Iron levels are below the 300 μg/L secondary Public

Drinking Water standard after settling and filtration. Also, the NDEQ allows for mixing zones in assessing compliance with Nebraska Drinking Water Supply water quality standards. As stated in the Nebraska's water quality standards (Chapter 2, 010.08A), mixing zones for public drinking water criteria shall be designed to not extend to within a 2-mile zone of influence from any public drinking water supply intake – i.e. a discharge with an approved mixing zone must not cause Public Drinking Water standards to be exceeded at a point 2 miles upstream of a public drinking water intake. Significant dilution of the dredging discharge will immediately occur upon mixing with the Missouri River. There are no drinking water intakes in the immediate vicinity of the proposed dredging discharge at the Desoto project site. The nearest downstream public drinking water intakes, Omaha, NE and Council Bluffs, IA, are approximately 20 miles downstream.

4.3.1.11 *Metals – Lead*

Constituent: Metals – Lead						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil (mg/kg)	Total (µg/L)	Dissolved (µg/L)	Total (µg/L)	Non-Filtered Total Analysis (µg/L)	Filtered Dissolved Analysis (µg/L)
DO-E1	12.3	23.7	<0.09	1,136	15.1	<0.09
DO-E2	11.5	23.7	<0.09	1,187	5.0	<0.09
DO-N1		23.7	<0.09	1,170		
DO-N2		23.7	<0.09	1,123		
DO-N3		23.7	<0.09	1,053		
MEAN	**11.9**	**-----**	**-----**	**1,134**	**10**	**<0.09**

Iowa Water Quality Standards – Lead; Use Class B(WW-1), Human Health – Fish Consumption

Constituent	Acute Standard (Total Recoverable)	Chronic Standard (Total Recoverable)	Human Health Standard (Total Recoverable)
Lead *Hardness = 277 mg/L*	299 µg/L	11.6 µg/L	-----

Nebraska Water Quality Standards – Lead; Warmwater Aquatic Life Class A and Public Drinking Water

Constituent	Acute Standard (Dissolved)	Chronic Standard (Dissolved)	Public Drinking Water Standard
Lead *Hardness = 277 mg/L*	192 µg/L	7.5 µg/L	N/A

Comparison of Lead Elutriate Tests to Water Quality Standards

Iowa's Lead criteria are expressed as Total Recoverable which was not directly measured in the analyses. Dissolved elutriate analyses were compared to Iowa's acute and chronic water quality standards. EPA guidance indicates the dissolved concentration of most metals indicates the bio-available form that can adversely impact aquatic life. Nebraska's Aquatic Life (acute and chronic) Lead criteria are expressed as dissolved. The filtered elutriate tests for Lead were all below Iowa's and Nebraska's acute and chronic standard for warmwater aquatic life protection.

4.3.1.12 *Metals – Manganese*

Constituent: Metals - Manganese						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil (mg/kg)	Total (µg/L)	Dissolved (µg/L)	Total (µg/L)	Non-Filtered Total Analysis (µg/L)	Filtered Dissolved Analysis (µg/L)
DO-E1		1,400	5J	59,090	660	<4
DO-E2		1,400	5J	57,830	730	<4
DO-N1		1,400	5J	63,300		
DO-N2		1,400	5J	60,840		
DO-N3		1,400	5J	70,150		
MEAN		-----	-----	**62,242**	**695**	**<4**

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

Iowa Water Quality Standards – Manganese; Use Class B(WW-1), Human Health – Fish Consumption

Constituent	Acute Standard	Chronic Standard	Human Health Standard
Manganese	-----	-----	-----

Nebraska Water Quality Standards – Manganese; Warmwater Aquatic Life Class A and Public Drinking Water

Constituent	Acute Standard (Dissolved)	Chronic Standard (Dissolved)	Public Drinking Water Standard (Secondary)
Manganese	-----	1,000 µg/L	50 µg/L

Comparison of Manganese Elutriate Tests to Water Quality Standards

Both filtered elutriate tests for Manganese were non-detect and below Nebraska's chronic standard. The total Manganese concentration (1,400 µg/L) of the collected receiving water from the Missouri River was above Nebraska's 50 µg/L secondary Public Drinking Water standard. Nebraska's water quality standards qualify the application of numerical criteria for public drinking water as follows:

> *"If the natural background level of a parameter is greater than the numerical standard, this shall not in and of itself prohibit the use of the surface water. If the natural background level of a parameter is greater than the numerical standard listed below, the background level shall be used in place of the numerical criteria."*

The elevated pre-elutriate and non-filtered elutriate samples are problematic for Nebraska's secondary Public Drinking Water use. However, the Nebraska water quality standards state that Public Drinking Water use is for surface waters which serve as a public drinking water supply. These waters must be treated (e.g., coagulation, sedimentation, filtration, chlorination) before the water is suitable for human consumption. After treatment, these waters are suitable for drinking water, food processing, and similar uses. As indicated by the filtered elutriate testing, Manganese levels are below

the 50 μg/L secondary Public Drinking Water standard after settling and filtration. Also, the NDEQ allows for mixing zones in assessing compliance with Nebraska Drinking Water Supply water quality standards. As stated in the Nebraska's water quality standards (Chapter 2, 010.08A), mixing zones for public drinking water criteria shall be designed to not extend to within a 2-mile zone of influence from any public drinking water supply intake – i.e. a discharge with an approved mixing zone must not cause Public Drinking Water standards to be exceeded at a point 2 miles upstream of a public drinking water intake. Significant dilution of the dredging discharge will immediately occur upon mixing with the Missouri River. There are no drinking water intakes in the immediate vicinity of the proposed dredging discharge at the Desoto project site. The nearest downstream public drinking water intakes, Omaha, NE and Council Bluffs, IA, are approximately 20 miles downstream.

4.3.1.13 *Metals – Mercury*

Constituent: Metals – Mercury						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil (mg/kg)	Total (µg/L)	Dissolved (µg/L)	Total (µg/L)	Non-Filtered Total Analysis (µg/L)	Filtered Dissolved Analysis (µg/L)
DO-E1	0.03J	0.04	<0.008	3.4	0.04J	<0.008
DO-E2	0.04J	0.04	<0.008	3.1	<0.008	<0.008
DO-N1		0.04	<0.008	3.0		
DO-N2		0.04	<0.008	3.0		
DO-N3		0.04	<0.008	3.3		
MEAN	**0.04J**	**-----**	**-----**	**3.2**	**0.02J**	**<0.008**

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

Iowa Water Quality Standards – Mercury; Use Class B(WW-1), Human Health – Fish Consumption

Constituent	Acute Standard	Chronic Standard	Human Health Standard
Mercury	1.64 µg/L	0.90 µg/L	0.15 µg/L

Nebraska Water Quality Standards – Mercury; Warmwater Aquatic Life Class A and Public Drinking Water

Constituent	Acute Standard (Dissolved)	Chronic Standard (Total Recoverable)	Public Drinking water Standard
Mercury	1.40 µg/L	0.77 µg/L	2 µg/L

Comparison of Mercury Elutriate Tests to Water Quality Standards

Iowa's acute, chronic, and Human Health Mercury criteria and Nebraska's chronic Mercury criteria are expressed as Total Recoverable which was not directly measured in the analyses. However, all the non-filtered and filtered elutriate tests for Mercury were below all the identified criteria for Mercury.

Reflective of the Mercury levels measured in the sediment/soil samples, the pre-elutriate samples for total mercury were slightly elevated. This could be problematic regarding Iowa's Human Health and Nebraska's Public Drinking Water standards. Nebraska water quality standards state that Public Drinking Water use is for surface waters which serve as a public drinking water supply. These waters must be treated (e.g., coagulation, sedimentation, filtration, chlorination) before the water is suitable for human consumption. After treatment, these waters are suitable for drinking water, food processing, and similar uses. As indicated by elutriate testing, Mercury levels are below the 2 µg/L Public Drinking Water standard after settling and filtration. Also, the NDEQ allows for mixing zones in assessing compliance with Nebraska Drinking Water Supply water quality standards. As stated in the Nebraska's water quality standards (Chapter 2, 010.08A), mixing zones for public drinking water criteria shall be designed to not extend to within a 2-mile zone of influence from any public drinking water supply intake – i.e. a discharge with an approved mixing zone must not cause Public Drinking Water standards to be exceeded at a point 2 miles upstream of a public drinking water intake. Iowa's Human Health standard is in regards

to risk associated with fish consumption. Bio-accumulation of Mercury in fish is highly dependent upon the bio-availability of the metal to fish. Significant dilution of the dredging discharge will immediately occur upon mixing with the Missouri River. There are no drinking water intakes in the immediate vicinity of the proposed dredging discharge at the Desoto project site. The nearest downstream public drinking water intakes, Omaha, NE and Council Bluffs, IA, are approximately 20 miles downstream.

4.3.1.14 *Metals – Nickel*

Constituent: Metals – Nickel						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil (mg/kg)	Total (μg/L)	Dissolved (μg/L)	Total (μg/L)	Non-Filtered Total Analysis (μg/L)	Filtered Dissolved Analysis (μg/L)
DO-E1	21.2	40	<4	2,130	30	10J
DO-E2	20.8	40	<4	2,370	10	20J
DO-N1		40	<4	2,440		
DO-N2		40	<4	2,160		
DO-N3		40	<4	2,140		
MEAN		**40**	**<4**	**2,248**	**20**	**15J**

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

Iowa Water Quality Standards – Nickel; Use Class B(WW-1), Human Health – Fish Consumption

Constituent	Acute Standard	Chronic Standard	Human Health Standard
Nickel *Hardness = 277 mg/L*	1,111 μg/L	124 μg/L	4,600 μg/L

NEBRASKA WATER QUALITY STANDARDS – Nickel; Warmwater Aquatic Life Class A and Public Drinking Water

Constituent	Acute Standard (Dissolved)	Chronic Standard (Dissolved)	Public Drinking Water Standard
Nickel *Hardness = 277 mg/L*	1,109 μg/L	123 μg/L	610 μg/L

Comparison of Nickel Elutriate Tests to Water Quality Standards

Iowa's Nickel criteria are expressed as Total Recoverable which was not directly measured in the analyses. Dissolved elutriate analyses were compared to Iowa's acute and chronic water quality standards. EPA guidance indicates the dissolved concentration of most metals indicates the bio-available form that can adversely impact aquatic life. Nebraska's Aquatic Life (acute and chronic) Nickel criteria are expressed as dissolved. The filtered elutriate tests for Nickel were all below Iowa's and Nebraska's acute and chronic standard for warmwater aquatic life protection.

Reflective of the Nickel levels measured in the sediment/soil samples, the pre-elutriate samples for total Nickel were elevated. This could be problematic regarding Nebraska's Public Drinking Water standard. Nebraska water quality standards state that Public Drinking Water use is for surface waters which serve as a public drinking water supply. These waters must be treated (e.g., coagulation, sedimentation, filtration, chlorination) before the water is suitable for human consumption. After treatment, these waters are suitable for drinking water, food processing, and similar uses. As indicated by elutriate testing, Nickel levels are below the 610 μg/L Public Drinking Water standard after settling and filtration. Also, the NDEQ allows for mixing zones in assessing compliance with Nebraska Drinking Water Supply water quality standards. As stated in the Nebraska's water quality standards (Chapter 2, 010.08A), mixing

zones for public drinking water criteria shall be designed to not extend to within a 2-mile zone of influence from any public drinking water supply intake – i.e. a discharge with an approved mixing zone must not cause Public Drinking Water standards to be exceeded at a point 2 miles upstream of a public drinking water intake. Significant dilution of the dredging discharge will immediately occur upon mixing with the Missouri River. There are no drinking water intakes in the immediate vicinity of the proposed dredging discharge at the Desoto project site. The nearest downstream public drinking water intakes, Omaha, NE and Council Bluffs, IA, are approximately 20 miles downstream.

4.3.1.15 *Metals – Selenium*

Constituent: Metals - Selenium						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil (mg/kg)	Total (µg/L)	Dissolved (µg/L)	Total (µg/L)	Non-Filtered Total Analysis (µg/L)	Filtered Dissolved Analysis (µg/L)
DO-E1		4	0.8J	82	6	5
DO-E2		4	0.8J	96	3	1
DO-N1		4	0.8J	89		
DO-N2		4	0.8J	69		
DO-N3		4	0.8J	84		
MEAN		-----	-----	**84**	**4.5**	**3**

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

Iowa Water Quality Standards – Selenium; Use Class B(WW-1), Human Health – Fish Consumption

Constituent	Acute Standard	Chronic Standard	Human Health Standard
Selenium	19.3 µg/L	N/A	170 µg/L

Nebraska Water Quality Standards – Selenium; Warmwater Aquatic Life Class A, Public Drinking Water and Agricultural Class A

Constituent	Acute Standard (Total Recoverable)	Chronic Standard (Total Recoverable)	Public Drinking Water Standard	Agricultural
Selenium	20 µg/L	5.0 µg/L	50 µg/L	20 µg/L

Comparison of Selenium Elutriate Tests to Water Quality Standards

Iowa's and Nebraska's acute and chronic warmwater aquatic life criteria are expressed as Total Recoverable which was not directly measured in the analyses. However, both the mean filtered and non-filtered results were below the identified acute and chronic criteria for both states (one value for site DO-E1 exceeded the Nebraska chronic criterion).

The pre-elutriate samples for total Selenium were elevated. This could be problematic regarding Nebraska's Public Drinking Water and Agricultural standards. Nebraska water quality standards state that Public Drinking Water use is for surface waters which serve as a public drinking water supply. These waters must be treated (e.g., coagulation, sedimentation, filtration, chlorination) before the water is suitable for human consumption. After treatment, these waters are suitable for drinking water, food processing, and similar uses. As indicated by elutriate testing, Selenium levels are below the 20 µg/L Public Drinking Water standard after settling and filtration. Also, the NDEQ allows for mixing zones in assessing compliance with Nebraska Drinking Water Supply water quality standards. As stated in the Nebraska's water quality standards (Chapter 2, 010.08A), mixing zones for public drinking water criteria shall be designed to not extend to within a 2-mile zone of influence from any public drinking water supply intake – i.e. a discharge with an approved mixing zone must not cause Public Drinking Water standards to be exceeded at a point 2 miles upstream of a public drinking water intake. Significant dilution of the dredging discharge will immediately occur upon mixing with the Missouri River. There are no drinking water intakes in the immediate vicinity of the proposed dredging discharge at the Desoto project site. The nearest downstream public drinking water intakes, Omaha, NE and Council Bluffs, IA, are approximately 20 miles downstream.

4.3.1.16 *Metals – Silver*

Constituent: Metals - Silver						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil (mg/kg)	Total (µg/L)	Dissolved (µg/L)	Total (µg/L)	Non-Filtered Total Analysis (µg/L)	Filtered Dissolved Analysis (µg/L)
DO-E1		<2	<4	<10	<2	<4
DO-E2		<2	<4	<10	<2	<4
DO-N1		<2	<4	<10		
DO-N2		<2	<4	<10		
DO-N3		<2	<4	<10		
MEAN		-----	-----	**<10**	**<2**	**<4**

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

Iowa Water Quality Standards – Silver; Use Class B(WW-1), Human Health – Fish Consumption

Constituent	Acute Standard	Chronic Standard	Human Health Standard
Silver *Hardness = 272 mg/L*	30 µg/L	-----	-----

Nebraska Water Quality Standards – Silver; Warmwater Aquatic Life Class A and Public Drinking Water

Constituent	Acute Standard (Dissolved)	Chronic Standard (Dissolved)	Public Drinking Water Standard (Secondary)
Silver *Hardness = 272 mg/L*	19 µg/L	-----	100 µg/L

Comparison of Silver Elutriate Tests to Water Quality Standards

The pre-elutriate samples and non-filtered and filtered elutriate tests for Silver were all below Iowa's and Nebraska's acute standard for warmwater aquatic life and Nebraska's Public Drinking Water standard.

4.3.1.17 *Metals – Thallium*

Constituent: Metals - Thallium						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil (mg/kg)	Total (µg/L)	Dissolved (µg/L)	Total (µg/L)	Non-Filtered Total Analysis (µg/L)	Filtered Dissolved Analysis (µg/L)
DO-E1		0.5	<0.005	26.8	0.30J	<0.005
DO-E2		0.5	<0.005	25.9	0.09J	<0.005
DO-N1		0.5	<0.005	26.1		
DO-N2		0.5	<0.005	24.2		
DO-N3		0.5	<0.005	23.4		
MEAN		-----	-----	**25.3**	**0.20J**	**<0.005**

Iowa Water Quality Standards – Thallium; Use Class B(WW-1), Human Health – Fish Consumption

Constituent	Acute Standard	Chronic Standard	Human Health Standard
Thallium	-----	-----	7.4 µg/L

Nebraska Water Quality Standards – Thallium; Warmwater Aquatic Life Class A and Public Drinking Water

Constituent	Acute Standard (Dissolved)	Chronic Standard (Dissolved)	Public Drinking Water Standard
Thallium	1,400 µg/L	0.47 µg/L	0.24µg/L

Comparison of Thallium Elutriate Tests to Water Quality Standards

The filtered elutriate tests for Thallium were all non-detect and below Nebraska's acute and chronic standards for warmwater aquatic life. The non-filtered elutriate tests were below Nebraska's Public Drinking Water standard and Iowa's Human Health standard.

The pre-elutriate samples for total Thallium were elevated. This could be problematic regarding Iowa's Human Health and Nebraska's Public Drinking Water standards. Nebraska water quality standards state that Public Drinking Water use is for surface waters which serve as a public drinking water supply. These waters must be treated (e.g., coagulation, sedimentation, filtration, chlorination) before the water is suitable for human consumption. After treatment, these waters are suitable for drinking water, food processing, and similar uses. As indicated by elutriate testing, Thallium levels are below the 0.24 µg/L Public Drinking Water standard after settling and filtration. Also, the NDEQ allows for mixing zones in assessing compliance with Nebraska Drinking Water Supply water quality standards. As stated in the Nebraska's water quality standards (Chapter 2, 010.08A), mixing zones for public drinking water criteria shall be designed to not extend to within a 2-mile zone of influence from any public drinking water supply intake – i.e. a discharge with an approved mixing zone must not cause Public Drinking Water standards to be exceeded at a point 2 miles upstream of a public drinking water intake. Iowa's Human Health standard is in regards to risk associated with fish consumption. Bio-accumulation of Thallium in fish is highly dependent upon the bio-availability of the metal to fish. Significant dilution of the dredging discharge will immediately occur upon mixing with the Missouri River. There are no drinking water intakes in the immediate vicinity of the proposed dredging discharge at the Desoto project site. The nearest downstream public drinking water intakes, Omaha, NE and Council Bluffs, IA, are approximately 20 miles downstream.

4.3.1.18 *Metals – Zinc*

Constituent: Metals – Zinc						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil (mg/kg)	Total (µg/L)	Dissolved (µg/L)	Total (µg/L)	Non-Filtered Total Analysis (µg/L)	Filtered Dissolved Analysis (µg/L)
DO-E1	65.2	120	<4	6,420	110	8J
DO-E2	59.8	120	<4	6,860	50	10J
DO-N1		120	<4	6,950		
DO-N2		120	<4	5,970		
DO-N3		120	<4	6,260		
MEAN		**-----**	**-----**	**6,492**	**80**	**9J**

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

Iowa Water Quality Standards – Zinc; Use Class B(WW-1), Human Health – Fish Consumption

Constituent	Acute Standard	Chronic Standard	Human Health Standard
Zinc *Hardness = 277mg/L*	284 µg/L	284 µg/L	26,000 µg/L

NEBRASKA WATER QUALITY STANDARDS – Zinc; Warmwater Aquatic Life Class A and Public Drinking Water

Constituent	Acute Standard (Dissolved)	Chronic Standard (Dissolved)	Public Drinking Water Standard (Secondary)
Zinc *Hardness = 277 mg/L*	278 µg/L	278 µg/L	5,000 µg/L

Comparison of Zinc Elutriate Tests to Water Quality Standards

All the filtered and non-filtered elutriate tests for Zinc were below Iowa's and Nebraska's acute and chronic standards for warmwater aquatic life. The non-filtered elutriate tests were below Iowa's Human Health and Nebraska's secondary Public Drinking Water standards.

Reflective of the Zinc levels measured in the collected sediment/soil samples, the pre-elutriate samples for total Zinc were somewhat elevated. This could be problematic regarding Nebraska's Public Drinking Water standards. Nebraska water quality standards state that Public Drinking Water use is for surface waters which serve as a public drinking water supply. These waters must be treated (e.g., coagulation, sedimentation, filtration, chlorination) before the water is suitable for human consumption. After treatment, these waters are suitable for drinking water, food processing, and similar uses. As indicated by elutriate testing, Zinc levels are below the 5,000 µg/L Public Drinking Water standard after settling and filtration. Also, the NDEQ allows for mixing zones in assessing compliance with Nebraska Drinking Water Supply water quality standards. As stated in the Nebraska's water quality standards (Chapter 2, 010.08A), mixing zones for public drinking water criteria shall be designed to not extend to within a 2-mile zone of influence from any public drinking water supply intake – i.e. a discharge with an approved mixing zone must not cause Public Drinking Water standards to be exceeded at a point 2 miles upstream of a public drinking water intake. Significant dilution of the dredging discharge will immediately occur upon mixing with the Missouri River. There are no drinking water intakes in the immediate vicinity of the proposed dredging discharge at the Desoto project site. The nearest downstream public drinking water intakes, Omaha, NE and Council Bluffs, IA, are approximately 20 miles downstream.

4.3.1.19 *Nitrate-Nitrite Nitrogen*

Constituent: Nitrate-Nitrite Nitrogen						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil (mg/kg)	Total (mg/L)	Dissolved (mg/L)	Total (mg/L)	Non-Filtered Total Analysis (mg/L)	Filtered Dissolved Analysis (mg/L)
DO-E1	9.8		1.3	4.80		4.48
DO-E2	0.2		1.3	1.24		1.15
DO-N1	16.1		1.3	6.16		
DO-N2	4.2		1.3	2.47		
DO-N3	28.7		1.3	10.80		
MEAN	**11.8**		**-----**	**5.09**		**2.82**

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

Iowa Water Quality Standards – Nitrate-Nitrite Nitrogen; Use Class B(WW-1), Human Health – Fish Consumption

Constituent	Acute Standard	Chronic Standard	Human Health Standard
Nitrate-Nitrite Nitrogen	-----	-----	-----

Nebraska Water Quality Standards – Nitrate-Nitrite Nitrogen; Agricultural Class A and Public Drinking Water

Constituent	Acute Standard	Chronic Standard	Agricultural	Public Drinking Water Standard
Nitrate-Nitrite Nitrogen	-----	------	100 mg/L	10 mg/L

Comparison of Nitrate-Nitrite Nitrogen Elutriate Tests to Water Quality Standards

All pre-elutriate samples and filtered elutriate tests were less than the Nebraska Agricultural Class A and Public Drinking Water standard for Nitrate-Nitrite Nitrogen.

4.3.1.20 *Organochlorine Pesticide Scan*

Constituent: Organochlorine Pesticide Scan						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil (mg/kg)	Total (µg/L)	Dissolved (µg/L)	Total (µg/L)	Non-Filtered Total Analysis (µg/L)	Filtered Dissolved Analysis (µg/L)
DO-E1	n.d.	n.d.			n.d.	
DO-E2	n.d.	n.d.			n.d.	
DO-E3	n.d.	n.d.			n.d.	
DO-E4	n.d.	n.d.			n.d.	

n.d. = Non-detect.

Detection and Reporting Limits – Organochlorine Pesticide Scan:

21 different pesticides were analyzed with varying detection and reporting levels – see Attachment 3.

Iowa Water Quality Standards – Organochlorine Pesticides; Use Class B(WW-1), Human Health – Fish Consumption

Nebraska Water Quality Standards – Organochlorine Pesticides; Warmwater Aquatic Life Class A and Human Health (Fish Consumption)

Organochlorine Pesticide	Acute Standard (µg/L)	Chronic Standard (µg/L)	Human Health Criterion (µg/L)
Aldrin	3	0.0005	0.0005
BHC	100	0.414	0.414
BHC (Alpha)	-----	0.049	0.049
BHC (Beta)	-----	0.17	0.17
Chlordane	2.4	0.0043	-----
DDT	1.1	0.001	-----
DDD	0.6	0.0031	0.0031
DDE	1,050	0.0022	0.0022
Dieldrin	0.24	0.00054	0.00054
Endosulfan (Alpha)	0.22	0.056	-----
Endosulfan (Beta)	0.22	0.056	-----
Endosulfan sulfate	-----	89	89
Endrin	0.086	0.036	-----
Endrin aldehyde	-----	0.30	0.30
Heptachlor	0.52	0.00079	0.00079
Heptachlor epoxide	0.52	0.00039	0.00039
Lindane	0.95	0.16	-----
Methoxychlor	-----	0.03	40
Toxaphene	0.73	0.002	0.0028

Comparison of Organochlorine Pesticide Scan Elutriate Tests to Water Quality Standards

All elutriate tests of the collected sediment/soil samples were non-detectable for the Organochlorine Pesticides included in the Scan. Some of Iowa's and Nebraska's water quality standards for the scanned pesticides were below the detection limits of the scan.

4.3.1.21 *Polychlorinated Biphenyls (PCBs) Scan*

Constituent: Polychlorinated Biphenyls						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil (mg/kg)	Total (µg/L)	Dissolved (µg/L)	Total (µg/L)	Non-Filtered Total Analysis (µg/L)	Filtered Dissolved Analysis (µg/L)
DO-E1	n.d.	n.d.			n.d.	
DO-E2	n.d.	n.d.			n.d.	
DO-E3	n.d.	n.d.			n.d.	
DO-E4	n.d.	n.d.			n.d.	

n.d. = Non-detect.

Detection and Reporting Limits – PCB Scan:

Varies by PCB congener – see Attachment 3.

Iowa Water Quality Standards – PCBs; Use Class B(WW-1), Human Health – Fish Consumption

Constituent	Acute Standard	Chronic Standard	Human Health Standard
Polychlorinated Biphenyls	2.0 µg/L	0.014 µg/L	0.00064 µg/L

Nebraska Water Quality Standards – PCBs; Warmwater Aquatic Life Class A and Human Health – Fish Consumption

Constituent	Acute Standard	Chronic Standard	Human Health Criterion
Polychlorinated Biphenyls	2.0 µg/L	0.00064 µg/L	0.00064 µg/L

Comparison of PCBs Scan Elutriate Tests to Water Quality Standards

All elutriate tests of the collected sediment/soil samples were non-detectable for the PCBs included in the Scan. Some of Iowa's and Nebraska's water quality standards for the scanned PCBs were below the detection limits of the scan.

4.3.1.22 *pH*

Constituent: pH						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil (S.U.)	Field (S.U.)	Lab (S.U.)	Lab (S.U.)	Non-Filtered Total Analysis (S.U.)	Filtered Dissolved Analysis (S.U.)
DO-E1	7.5	8.5	8.2	7.5	7.7	
DO-E2	7.4	8.5	8.2	7.6	7.8	
DO-N1	7.4	8.5	8.2	7.6		
DO-N2	7.5	8.5	8.2	7.7		
DO-N3	7.3	8.5	8.2	7.6		

Iowa Water Quality Standards – pH; Use Class B(WW-1)

Constituent	Minimum Standard	Maximum Standard
pH	6.5 S.U.	9.0 S.U.

Nebraska Water Quality Standards – pH; Warmwater Aquatic Life Class A

Constituent	Minimum Standard	Maximum Standard
pH	6.5 S.U.	9.0 S.U.

Comparison of pH Elutriate Tests to Water Quality Standards

The pH of all pre-elutriate and elutriate tests of the collected sediment/soil samples were within the minimum and maximum pH criteria identified by Iowa and Nebraska.

4.3.2 Analyzed Constituents with No Promulgated State Water Quality Standards

The following constituents were analyzed and have no water quality standards numeric criteria promulgated by the State of Iowa or Nebraska:

- Carbonaceous Biochemical Oxygen Demand, 5-Day ($CBOD_5$)
- Chemical Oxygen Demand (COD)
- Kjeldahl Nitrogen, Total (TKN)
- Percent Solids
- Total Organic Carbon (TOC)
- Total Phosphorus
- Total Suspended Solids
- Turbidity

4.3.2.1 *Carbonaceous Biochemical Oxygen Demand (5-day)*

Constituent: Carbonaceous Biochemical Oxygen Demand (5-Day)						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil (mg/kg)	Total (mg/L)	Dissolved (mg/L)	Total (mg/L)	Non-Filtered Total Analysis (mg/L)	Filtered Dissolved Analysis (mg/L)
DO-E1		2J		6	2J	
DO-E2		2J		7	1J	
DO-N1		2J		6		
DO-N2		2J		5		
DO-N3		2J		7		
MEAN		**-----**		**6.2**	**1J**	

4.3.2.2 *Chemical Oxygen Demand*

Constituent: Chemical Oxygen Demand						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil (mg/kg)	Total (mg/L)	Dissolved (mg/L)	Total (mg/L)	Non-Filtered Total Analysis (mg/L)	Filtered Dissolved Analysis (mg/L)
DO-E1		74		2,410	23	
DO-E2		74		2,100	7	
DO-N1		74		2,760		
DO-N2		74		1,760		
DO-N3		74		3,310		
MEAN		**-----**		**2,468**	**15**	

4.3.2.3 *Total Kjeldahl Nitrogen*

Constituent: Total Kjeldahl Nitrogen						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil (mg/kg)	Total (mg/L)	Dissolved (mg/L)	Total (mg/L)	Non-Filtered Total Analysis (mg/L)	Filtered Dissolved Analysis (mg/L)
DO-E1	921	2.16		109	2.16	
DO-E2	579	2.16		88	0.99	
DO-N1	1,080	2.16		122		
DO-N2	942	2.16		87		
DO-N3	802	2.16		157		
MEAN	**865**	**-----**		**113**	**1.58**	

4.3.2.4 *Percent Solids*

Constituent: Percent Solids						
Sample Location	Sediment/Soil (%)					
DO-E1	78.1					
DO-E2	72.3					
DO-N1	77.1					
DO-N2	77.0					
DO-N3	81.3					
MEAN	**77.2**					

4.3.2.5 *Total Organic Carbon*

Constituent: Total Organic Carbon						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil (mg/kg)	Total (mg/L)	Dissolved (mg/L)	Total (mg/L)	Non-Filtered Total Analysis (mg/L)	Filtered Dissolved Analysis (mg/L)
DO-E1	21,300	17.9		1,530	11.0	
DO-E2	8,600	17.9		1,120	3.1	
DO-N1	12,300	17.9		1,380		
DO-N2	15,800	17.9		1,080		
DO-N3	15,000	17.9		1,960		
MEAN	**14,600**	**-----**		**1,414**	**7.1**	

4.3.2.6 *Phosphorus*

Constituent: Phosphorus						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil (mg/kg)	Total (mg/L)	Dissolved (mg/L)	Total (mg/L)	Non-Filtered Total Analysis (mg/L)	Filtered Dissolved Analysis (mg/L)
DO-E1	792	1.01	0.05J	69.4	0.74	0.44
DO-E2	650	1.01	0.05J	74.7	0.17	0.07
DO-N1	839	1.01	0.05J	75.8		
DO-N2	775	1.01	0.05J	76.3		
DO-N3	749	1.01	0.05J	64.6		
MEAN	**761**	**-----**	**-----**	**72.2**	**0.46**	**0.26**

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

4.3.2.7 *Total Suspended Solids*

Constituent: Total Suspended Solids						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil (mg/kg)	Total (mg/L)	Dissolved (mg/L)	Total (mg/L)	Non-Filtered Total Analysis (mg/L)	Filtered Dissolved Analysis (mg/L)
DO-E1		1,040		135,000	752	
DO-E2		1,040		153,000	173	
DO-N1		1,040		130,000		
DO-N2		1,040		116,000		
DO-N3		1,040		103,000		
MEAN		**-----**		**127,400**	**463**	

4.3.2.8 *Turbidity*

Constituent: Turbidity						
		Receiving Water (Missouri River)		Pre-Elutriate Water	Elutriate Water	
Sample Location	Sediment/Soil	Total (NTU)	Dissolved (NTU)	Total (NTU)	Non-Filtered Total Analysis (mg/L)	Filtered Dissolved Analysis (mg/L)
DO-E1		730		39,600	590	
DO-E2		730		35,800	151	
DO-N1		730		40,100		
DO-N2		730		32,300		
DO-N3		730		36,500		
MEAN		**-----**		**36,860**	**371**	

5 WATER QUALITY FACTUAL DETERMINATIONS

5.1 Physical Substrate Determinations

Table 4 and Figure 4 described the particle size composition of the material identified for excavation for the construction of SWH at the proposed Desoto project site. A mean particle size composition for the material identified for excavation at the proposed project site was calculated from the five collected sediment/soil samples. The sediment/soil to be excavated is believed to be alluvial material.

As part of Bank Stabilization and Navigation Project (BSNP), the Omaha District irregularly samples substrate composition in the navigation channel of the Missouri River. In 2008, particle size composition of the river bottom was measured at sites along the river. At each location two to three substrate samples were collected from the navigation channel. Table 5 shows the particle size composition of the substrate samples collected from the navigation channel upstream and downstream of the proposed Desoto project site (RM640.1) at RM645 and RM640. The substrate particle size composition in the navigation channel of the Missouri River indicates that the finer material has been washed out and transported downstream. This is in line with the management goals of the BSNP to maintain the navigation channel.

Table 5. Summary of particle size analysis of the sediment samples collected from the Missouri River navigation channel at RM645 and RM640 during 2008.

		% Gravel		% Sand			% Fines	
Sample Location	**% Cobbles**	**Coarse**	**Fine**	**Coarse**	**Medium**	**Fine**	**Silt**	**Clay**
RM645 - 70178	0.0	0.0	0.1	0.5	34.8	64.3	0.3	
RM645 - 70179	0.0	0.0	0.8	1.7	42.1	55.0	0.4	
RM645 - 70180	0.0	0.0	0.1	0.4	16.5	82.8	0.2	
MEAN RM645	**0.0**	**0.0**	**0.3**	**0.9**	**31.1**	**67.4**	**0.3**	
RM640 - 70181	0.0	0.0	0.0	0.1	12.4	87.2	0.3	
RM640 - 70182	0.0	0.0	0.1	0.1	9.8	89.8	0.2	
MEAN RM640	**0.0**	**0.0**	**0.1**	**0.1**	**11.1**	**88.5**	**0.3**	

Figure 5 plots the mean particle size composition of the sediment/soil samples collected at the proposed Desoto project site and from the navigation channel of the Missouri River at RM645 and RM640. As seen in Figure 5, the sediment identified for excavation at the proposed Desoto project site, as compared to the bottom substrate of the Missouri River navigation channel, has a more fines. This is not unexpected given that the existing sediment to be dredged at the proposed project site is believed to be alluvial material deposited in the floodplain under lower velocities than the main navigation channel. As occurs with sediment delivered from inflowing tributaries, the finer material in the proposed dredging discharge will be transported downstream as part of the wash-load, and any heavier material will be incorporated into the Missouri River bed-load.

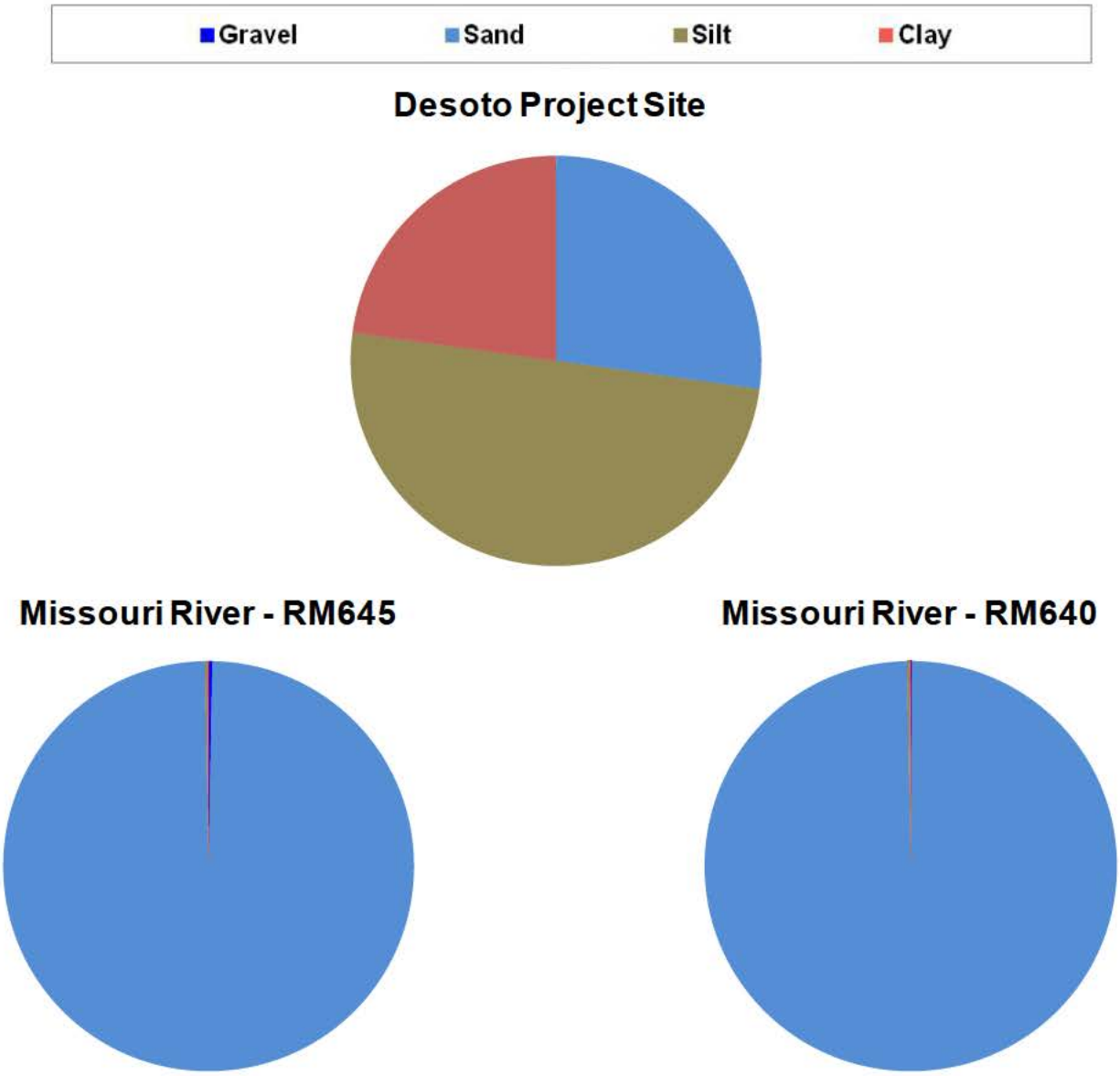

Figure 5. Particle size composition of likely dredge material at the proposed Desoto project site and the substrate of the Missouri River bottom in the navigation channel in the area of the proposed project.

5.2 Suspended Particulate/Turbidity Determinations

The dredge slurry discharge at the "end-of-pipe" will have a high total suspended solids (TSS) concentration and be quite turbid. Table 6 provides the TSS and turbidity levels measured in the pre-elutriate samples prepared from sediment/soil samples collected at the proposed Desoto project site. Some local impacts to existing Missouri River water quality from TSS and turbidity can be expected in the immediate vicinity of the dredging discharge.

Table 6. Total suspended solids and turbidity levels measured in pre-elutriate samples prepared from sediment/soil samples collected at the proposed Desoto project site.

Sediment/Soil Sample	Total Suspended Solids (mg/L)	Turbidity (NTU)
DO-E1	135,000	39,600
DO-E2	153,000	35,800
DO-N1	130,000	40,100
DO-N2	116,000	32,300
DO-N3	103,000	36,500
MEAN	**127,400**	**36,860**

Past dredging discharges to construct SWH have attempted to minimize any such impacts by targeted placement of the dredging discharge in the Missouri River (e.g. mid-channel, mid-depth, etc.). The Omaha District assessed in-river TSS and turbidity levels upstream and downstream of the dredging discharge during construction of SWH at the California Bend project site. Four sites were monitored: 1) upstream of the "end-of-pipe", 2) zone of initial dilution at the dredging discharge, 3) 200 feet downstream of the "end-of-pipe" in the discharge plume, and 4) 2,000 feet downstream of the "end-of-pipe in the discharge plume. Table 7 gives TSS and turbidity levels measured at the four locations during dredging discharge in September 2003. Figure 6 plots the same information. As seen in Table 7 and Figure 6, TSS and turbidity levels are elevated in the zone of initial dilution; however, these levels quickly dissipate downstream in the discharge plume.

Table 7. Total suspended solids and turbidity levels monitored in the Missouri River upstream and downstream of the dredging discharge to construct shallow-water habitat at the California Bend project site in 2003.

	Upstream of Discharge		Zone of Initial Dilution		200 Feet Downstream		2,000 Feet Downstream	
Date	TSS (mg/L)	Turbidity (NTUs)	TSS (mg/L)	Turbidity (NTUs)	TSS (mg/L)	Turbidity (NTUs)	TSS (mg/L)	Turbidity (NTUs)
5-Sep-03	46	30	331	218	81	90	29	38
12-Sep-03	84	43	629	414	144	94	74	56

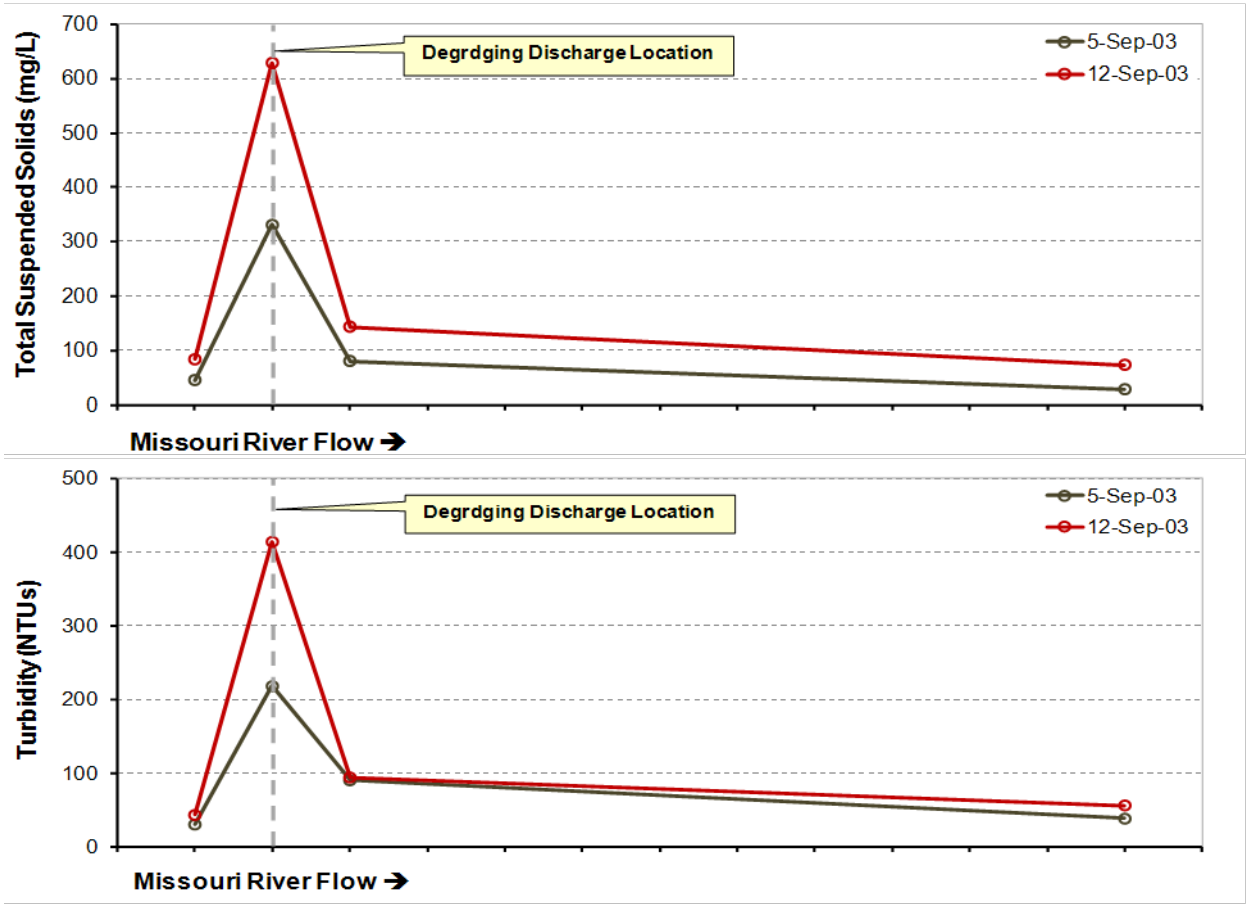

Figure 6. Total suspended solids and turbidity levels monitored in the Missouri River upstream and downstream of the dredging discharge to construct shallow-water habitat at the California Bend project in 2003.

5.3 Contaminant Determinations

5.3.1 Constituents with Promulgated State Water Quality Standards' Criteria

Elutriate testing of representative sediment/soil samples collected at the proposed Desoto project included analysis for the following constituents that the States of Iowa or Nebraska have promulgated water quality standards criteria: Ammonia; Atrazine; Metals: Aluminum, Antimony, Arsenic, Beryllium, Cadmium, Chromium III, Copper, Iron, Lead, Manganese, Mercury, Nickel, Selenium, Silver, Thallium, Zinc; Nitrate-Nitrite Nitrogen; Organochlorine Pesticides; PCBs; and pH. With the exception of Cadmium and Selenium, none of the prepared elutriate samples exceeded promulgated Iowa or Nebraska water quality standards criteria for warmwater aquatic life protection. One elutriate test (dissolved) for Cadmium and Selenium exceeded the Nebraska chronic criterion for Warmwater Aquatic Life Class, but was below the acute criterion.

The prepared pre-elutriate samples exhibited elevated concentrations, as total, for several metals. This could be a problematic concern for these metals regarding Nebraska's Public Drinking Water standards. However, Nebraska's water quality standards state that Public Drinking Water use is for surface waters which serve as a public drinking water supply. These waters must be treated (e.g.,

coagulation, sedimentation, filtration, chlorination) before the water is suitable for human consumption. After treatment, these waters are suitable for drinking water, food processing, and similar uses. As indicated by elutriate testing, the problematic pre-elutriate metal concentrations were below Nebraska's Public Drinking Water standards after settling and filtration. Also, the NDEQ allows for mixing zones in assessing compliance with Nebraska Drinking Water Supply water quality standards. As stated in the Nebraska's water quality standards (Chapter 2, 010.08A), mixing zones for public drinking water criteria shall be designed to not extend to within a 2-mile zone of influence from any public drinking water supply intake – i.e. a discharge with an approved mixing zone must not cause Public Drinking Water standards to be exceeded at a point 2 miles upstream of a public drinking water intake. Significant dilution of the dredging discharge will immediately occur upon mixing with the Missouri River. There are no drinking water intakes in the immediate vicinity of the proposed dredging discharge at the Desoto project site. The nearest downstream public drinking water intakes, Omaha, NE and Council Bluffs, IA, are approximately 20 miles downstream.

5.3.2 Nutrients

Table 8 summaries the nutrient analyses of sediment/soil samples collected at the proposed Desoto project site, and pre-elutriate and elutriate samples prepared from the collected sediment/soil samples. Pre-elutriate samples characterize total nutrients (i.e. settable, suspended, and dissolved) in the prepared 1:4 (sediment to receiving water) mixture. Non-filtered elutriate samples characterize suspended and dissolved nutrients remaining in the mixture supernatant after 1-hour of settling. Filtered elutriate samples characterize dissolved nutrients in the supernatant of the settled mixture. Pre-elutriate samples represent potential "end-of-pipe" nutrient concentrations of the slurry discharge prior to any mixing with the receiving water (i.e. Missouri River). Pre-elutriate samples were analyzed for Total Kjeldahl Nitrogen, Nitrate/Nitrite Nitrogen, and Total Phosphorus. Non-filtered elutriate samples were analyzed for Total Kjeldahl Nitrogen, Total Ammonia Nitrogen, and Total Phosphorus. Standard, filtered elutriate samples were analyzed for dissolved Nitrate-Nitrite Nitrogen and dissolved Phosphorus.

5.3.2.1 Estimated Total Tonnage of Nutrients to be Discharged to the Missouri River

It is estimated that that a total of 240,000 cubic yards of material would be excavated and discharged to the Missouri River to construct SWH at the proposed Desoto project. Table 4 and Figure 4 describe the particle size composition of the material proposed for excavation. Based on the alluvial material to be excavated, a conversion factor of 90 lbs/ft^3 was used to convert the estimated material volume (240,000 yd^3) to estimated material weight (291,600 tons). The metric tonnage of nutrients that would be discharged to the Missouri River during the period of SWH construction was estimated from the mean nutrient levels determined for the collected sediment/soil samples and the total material to be excavated (Table 9). Currently, the total phosphorus load to the Gulf of Mexico is estimated to be 154,300 metric tons per year, with the contribution of the Missouri River to this total load estimated to be between 16.8% and 20% (NRC, 2011). If the proposed SWH construction at Desoto was completed within one year and the estimated total discharge of 207.31 metric tons of total phosphorus made it to the Gulf of Mexico in one year, it would represent 0.71% of the annual Missouri River total phosphorus load delivered to the Mississippi River, and 0.13% of the annual total phosphorus load delivered to the Gulf of Mexico. These percentages are upper bound estimates, as sediment deposition processes in the Missouri and Mississippi River channels would reduce loads delivered to the Gulf, and actual downstream deliveries would be less than these values.

Table 8. Summary of nutrient analyses of sediment/soil samples collected at the proposed Desoto shallow-water habitat site and pre-elutriate and elutriate testing of the collected sediment/soil samples.

	Total Kjeldahl N (mg/L)	Ammonia N (mg/L)	Nitrate-Nitrite N (mg/L)	Phosphorus (mg/L)
Site DO-E1:				
Sediment/Soil	921*	0.7*	9.8*	792*
Pre-Elutriate	109	-----	4.80	69.4
Non-Filtered Elutriate	2.16	0.11	-----	0.74
Dissolved Elutriate	-----	0.10	4.48	0.44
Site DO-E2				
Sediment/Soil	579*	2.7*	0.2*	650*
Pre-Elutriate	88	-----	1.24	74.7
Non-Filtered Elutriate	0.99	0.29	-----	0.17
Dissolved Elutriate	-----	0.30	1.15	0.07
Site DO-N1:				
Sediment/Soil	1,080*	0.6*	16.1*	839*
Pre-Elutriate	122	-----	6.16	75.8
Site DO-N2:				
Sediment/Soil	942*	0.9*	4.2*	775*
Pre-Elutriate	87	-----	2.47	76.3
Site DO-N3:				
Sediment/Soil	802*	0.7*	28.7*	749*
Pre-Elutriate	157	-----	10.80	64.6
Mean Concentration				
Sediment/Soil	**865***	**1.12***	**11.8***	**761***
Pre-Elutriate	**113**	**-----**	**5.09**	**72.2**
Non-Filtered Elutriate	**1.58**	**0.20**	**-----**	**0.46**
Dissolved Elutriate	**-----**	**0.20**	**2.82**	**0.26**

* mg/kg

Table 9. Estimated metric tonnage of nutrients that would be discharged to the Missouri River during the entire period shallow-water habitat was constructed at the proposed Desoto project.

Total Kjeldahl Nitrogen (metric tons)	Ammonia (metric tons)	Nitrate-Nitrite Nitrogen (metric tons)	Total Phosphorus (metric tons)
228.83	0.30	3.12	207.31

Note: 1 metric ton = 1,000 kg = 2,205 lbs.

5.3.2.2 Potential Impacts to Missouri River Water Quality

5.3.2.2.1 Dredging Discharge Flows

The following information was taken from EM 1110-2-5025 (25-Mar-1983), "*Dredging and Dredged material Disposal*" (USACE, 1983):

> "The hydraulic pipeline cutterhead suction dredge … is equipped with a rotating cutter apparatus surrounding the intake end of the suction pipe, it can effectively dig and pump all types of alluvial materials and compacted deposits, such as clay and hardpan. Slurries of 10 to 20 percent solids (by dry weight) are typical, depending upon the material being dredged, dredging depth, horsepower of dredge pumps, and pumping distance to disposal area. If no other data are

available, a pipeline discharge concentration of 13 percent by dry weight (145 ppt) should be used for design purposes. Pipeline discharge velocity, under routine working conditions, ranges from 15-20 ft/sec. Table 10 presents theoretical pipeline discharge rates as functions of pipeline discharge velocity for dredges ranging from 8 to 30 in."

Table 10. Suction dredge pipeline discharge rates (cfs)[(a)] [taken from EM 1110-2-5025].

	Discharge Pipe Diameter			
Discharge Velocity (ft/sec)	**8-inch**	**18-inch**	**24-inch**	**30-inch**
10	3.5	17.7	31.4	49.1
15	5.2	26.5	47.1	73.6
20	7.0	35.3	62.8	98.1
25	8.7	44.2	78.5	122.7

(a) Discharge rate = pipeline area x discharge velocity.
Discharge rate for 20-inch diameter pipe:
Pipe radius = 10 in. = 0.833 ft.
Pipe area = $\pi r^2 = (3.1416)(0.833)^2 = 2.18$ ft^2
Discharge rate = 2.18 ft^2 x 20 ft/sec = 43.6 cfs
Note: Given a velocity of 20 ft/sec was used, this is a maximum estimate for discharge rate.

5.3.2.2.2 Elutriate Testing of Sediment/Soil Samples Collected at the Desoto Site

Elutriate testing of the sediment/soil samples collected at the proposed Desoto project site was done pursuant to the "*Inland Testing Manual"*. A test slurry was prepared based on a dilution of 1 part sediment to 4 parts receiving water on a volume basis. The 1:4 dilution for elutriate testing represents a 20% slurry. However, elutriate testing is done using "wet" sediment to avoid volatilization of any potential contaminants in the sediment during a drying process. The "wet" sediment was analyzed for percent solids and the amount of water present in the sediment sample can be mathematically converted to "dry weight" based on the percent solids quantification. Table 11 estimates the dry-weight percent slurries for each of the elutriate mixtures prepared from the sediment/soil samples collected at the proposed project site. The percent slurry estimate is based on the measured percent solids of the collected sediment/soil samples and the 1:4 dilution used to prepare elutriate samples. All of the prepared elutriate mixtures from the collected sediment/soil samples fall within the 10 to 20 percent solids (by dry weight) typical for a hydraulic pipeline cutterhead suction dredge (Table 11).

Table 11. Dry-weight percent slurries represented by the elutriate mixtures prepared from the sediment/soil samples collected at the proposed Desoto shallow-water habitat site.

Sediment/Soil Sample	Percent Solids	Percent Slurry (Based on Estimated Dry Weight)
DO-E1	78.1%	15.6%
DO-E2	72.3%	14.5%
DO-N1	77.1%	15.4%
DO-N2	77.0%	15.4%
DO-N3	81.3%	16.3%

Note: Based on a 1:4 (dry-weight sediment to water ratio):
- 100% percent solids = 20% slurry
- 50% percent solids = 10% slurry

5.3.2.2.3 Missouri River Nutrient Conditions at Desoto Area on 17-May-2013

Table 12, Table 13, and Table 14, respectively, summarize the nutrient concentrations, fluxes, and loadings present in the Missouri River on 17-May-2013 when sediment/soil samples were collected at the proposed Desoto project site.

Table 12. Nutrient concentrations measured in the Missouri River at RM641 on 17-May-2013.

Total Kjeldahl N (mg/L)	Ammonia N (mg/L)	Nitrate-Nitrite N (mg/L)	Total P (mg/L)	Dissolved P (mg/L)
2.16	0.22	1.13	1.01	0.05

Table 13. Estimated nutrient fluxes in the Missouri River at RM641 on 17-May-2013 based on measured nutrient concentrations and recorded mean daily flow of 26,200 cfs.

Flow (cfs)	Total Kjeldahl N (kg/sec)	Ammonia N (kg/sec)	Nitrate-Nitrite N (kg/sec)	Total P (kg/sec)	Dissolved P (kg/sec)
26,200	1.6025	0.1632	0.8383	0.7493	0.0371

Table 14. Estimated daily nutrient loadings in the Missouri River at RM641 on 17-May-2013 based on estimated nutrient fluxes.

Flow (cfs)	Total Kjeldahl N (tons/day)	Ammonia N (tons/day)	Nitrate-Nitrite N (tons/day)	Total P (tons/day)	Dissolved P (tons/day)
26,200	152.6	15.5	79.8	71.4	3.5

5.3.2.2.4 Missouri River Mean Nutrient Conditions at Omaha (RM619) and Rulo (RM498) Nebraska

Mean nutrient conditions were determined for the Missouri River at Omaha (RM619) and Rulo (RM498) Nebraska from monthly water quality sampling of the river by the District at the two sites over the 10-year period 2003 through 2012 (Table 15). The Omaha site represents conditions of the Missouri River in the area of the proposed Desoto project, and the Rulo site the conditions of the Missouri River as it leaves the District.

Table 15. Long-term mean nutrient concentrations measured in the Missouri River at Omaha (RM619) and Rulo (RM498) Nebraska by the Omaha District over the 10-year period 2003 through 2012.

Location	Total Kjeldahl N (mg/L)	Ammonia N (mg/L)	Nitrate-Nitrite N (mg/L)	Total P (mg/L)	Dissolved P (mg/L)
Omaha, NE (RM619)	1.06	0.14	1.51	0.27	0.07
Rulo, NE (RM498)	1.22	0.15	1.68	0.36	0.09

The average mean daily flow of the Missouri River at Omaha (USGS gauge 06610000) and Rulo (USGS gauge 06813500) Nebraska was determined from USGS flow records. The average mean daily flow of the Missouri River at Omaha (period of record 1967 -2012) was determined to be 36,298 cfs (range = 5,460 – 212,000 cfs; median = 34,100 cfs). The average mean daily flow of the Missouri River at Rulo (period of record 1967 -2012) was determined to be 46,151 cfs (range = 7,450 – 302,000 cfs; median = 28,500 cfs). The mean daily flows were used to determine nutrient fluxes and loadings based

on the Missouri River water quality conditions monitored by the Omaha District over the 10-year period 2003 through 2012. Table 16 and Table 17, respectively, summarize the mean nutrient fluxes and loadings for the Missouri River at Omaha and Rulo, Nebraska.

Table 16. Estimated mean nutrient fluxes in the Missouri River at Omaha, NE (RM619) and Rulo, NE (RM498) based on period of record flows and water quality conditions monitored during the 10-year period 2003 through 2012.

Location	Flow (cfs)	Total Kjeldahl N (kg/sec)	Ammonia N (kg/sec)	Nitrate-Nitrite N (kg/sec)	Total P (kg/sec)	Dissolved P (kg/sec)
Omaha, NE (RM619)	36,298	1.0895	0.1439	1.5520	0.2775	0.0719
Rulo, NE (RM498)	46,151	1.5943	0.1960	2.1954	0.4705	0.1176

Table 17. Estimated mean nutrient loadings in the Missouri River at Omaha, NE (RM619) and Rulo, NE (RN498) based on estimated mean nutrient fluxes.

Location	Flow (cfs)	Total Kjeldahl N (tons/day)	Ammonia N (tons/day)	Nitrate-Nitrite N (tons/day)	Total P (tons/day)	Dissolved P (tons/day)
Omaha, NE (RM619)	36,298	103.8	13.7	147.8	26.4	6.9
Rulo, NE (RM498)	46,151	151.8	18.7	209.1	44.8	11.2

5.3.2.2.5 Estimation of Nutrient Loadings from Potential Hydraulic Dredging Discharge for the Construction of SWH at the Proposed Desoto Project Site

5.3.2.2.5.1 Calculated Nutrient Fluxes and Loadings from a Potential 20-Inch Hydraulic Dredge Discharge of Excavated Sediment/Soil

Potential nutrient fluxes from hydraulic dredging to excavate SWH at the proposed Desoto project site were calculated. The calculated nutrient fluxes were based on use of a typical 20-inch hydraulic dredge (i.e. 43.6 cfs discharge), and mean nutrient levels determined from the sediment/soil samples collected from the proposed project site. As appropriate, nutrient fluxes for total (pre-elutriate and non-filtered elutriate), and dissolved (filtered elutriate) nutrients were estimated from pre-elutriate and elutriate testing results. Table 18 shows the calculated nutrient fluxes for Total Kjeldahl Nitrogen, Ammonia, Nitrate-Nitrite Nitrogen, Total Phosphorus, and Dissolved Phosphorus. Table 19 shows the estimated daily loadings (tons/day) based on the calculated nutrient fluxes. Table 20 compares the nutrient daily loadings calculated for the 20-inch hydraulic dredge discharge to the long-term average daily loadings for the Missouri River at Omaha (RM619) and Rulo (RM498) Nebraska.

Table 18. Nutrient flux rates calculated for a typical 20-inch hydraulic dredge discharge (43.6 cfs) based on mean sediment/soil nutrient levels sampled at the proposed Desoto project site.

Total Kjeldahl Nitrogen (kg/sec)		Ammonia (kg/sec)	Nitrate-Nitrite Nitrogen (kg/sec)		Phosphorus (kg/sec)		
Pre-Elutriate	Non-Filtered Elutriate	Non-Filtered Elutriate	Pre-Elutriate	Filtered Elutriate	Pre-Elutriate	Non-Filtered Elutriate	Filtered Elutriate
0.1395	0.0020	0.0002	0.0063	0.0035	0.0891	0.0006	0.0003

Table 19. Nutrient loadings estimated for a typical 20-inch hydraulic dredge discharge (43.6 cfs) operating 12 hours a day based on nutrient fluxes calculated for mean sediment/soil nutrient levels sampled at the proposed Desoto project site.

Total Kjeldahl Nitrogen (tons/day)		Ammonia (tons/day)	Nitrate-Nitrite Nitrogen (tons/day)		Phosphorus (tons/day)		
Pre-Elutriate	Non-Filtered Elutriate	Non-Filtered Elutriate	Pre-Elutriate	Filtered Elutriate	Pre-Elutriate	Non-Filtered Elutriate	Filtered Elutriate
6.644	0.093	0.012	0.299	0.166	4.245	0.027	0.015

Table 20. Comparison of daily nutrient loadings for the estimated dredging discharge from the proposed Desoto shallow-water habitat construction project and the Missouri River average conditions at Omaha (RM619) and Rulo (RM498) Nebraska.

Total Kjeldahl Nitrogen (tons/day)		Ammonia (tons/day)	Nitrate-Nitrite Nitrogen (tons/day)		Phosphorus (tons/day)		
Pre-Elutriate	Non-Filtered Elutriate	Non-Filtered Elutriate	Pre-Elutriate	Filtered Elutriate	Pre-Elutriate	Non-Filtered Elutriate	Filtered Elutriate
20-inch Hydraulic Dredge Discharge (43.6 cfs)							
6.644	0.093	0.012	0.299	0.166	4.245	0.027	0.015
Missouri River Long-Term Mean Conditions at Omaha – RM619 (Mean Flow = 36,298 cfs)							
103.8		13.7	147.8		26.4		6.9
20-in Hydraulic Dredge Discharge Load as a Percent of the Long-term Mean Missouri River Load at RM619							
6.40%	0.09%	0.09%	0.20%	0.11%	16.08%	0.10%	0.22%
Missouri River Long-Term Mean Conditions at Rulo – RM498 (Mean Flow = 46,151 cfs)							
151.8		18.7	209.1		44.8		11.2
20-in Hydraulic Dredge Discharge Load as a Percent of the Long-term Mean Missouri River Load at RM498							
4.38%	0.06%	0.06%	0.14%	0.08%	9.48%	0.06%	0.13%

Note: Dredge flow (43.6 cfs) to mean Missouri River flow (46,151 cfs) is 0.09% (i.e. a dredging discharge of 43.6 cfs would represent 0.09% of the mean Missouri River flow of 46,151 cfs when the dredge was discharging).

5.3.2.2.6 Comparison of Estimated Nutrient Loadings from Hydraulic Dredging at the Proposed Desoto Project to Ambient Nutrient Loadings in the Missouri River

The District monitors water quality conditions in the Missouri River from near Landusky, MT (RM1922) to Rulo, NE (RM498). This includes seven locations monitored monthly since 2003 from the Gavins Point Dam tailwaters (RM810) to Rulo, NE. Nutrient constituents monitored monthly include Total Kjeldahl Nitrogen, Ammonia, Nitrate-Nitrite, Total Nitrogen, Total Phosphorus, and Dissolved Phosphorus. Figure 7 displays the mean daily loads calculated for Total Nitrogen, Nitrate-Nitrite Nitrogen, and Total Phosphorus for the seven monitored locations on the Missouri River downstream of Gavins Point Dam over the 5-year period 2007 through 2011. Figure 7 also shows the location of the proposed Desoto project site. Figure 8 compares the estimated daily dredging discharge loading for Total Nitrogen, Nitrate-Nitrite Nitrogen, and Total Phosphorus and the calculated mean daily loads for the Missouri River immediately upstream (i.e. RM691) and downstream (i.e. RM619) of the proposed Desoto project site. Total nitrogen was determined by adding Total Kjeldahl Nitrogen and Nitrate-Nitrite Nitrogen. As indicated in Table 20 and Figure 8, the estimated daily nutrient loading from the proposed Desoto project site is minor compared to the nutrient mean daily loading currently present in the Missouri

River. It is noted that some of the discharged particulate material, and associated phosphorus, would settle to the bottom of the Missouri River when discharged and be incorporated in the river's bed-load. The difference between a pre-elutriate sample and a non-filtered sample for Total Phosphorus is 1-hour of settling time. The elutriate testing of the collected Desoto sediment samples resulted in mean pre-elutriate and non-filtered elutriate Total Phosphorus concentrations of 72.2 mg/L and 0.46 mg/L, respectively (i.e. 99.4% of the total phosphorus present in the pre-elutriate samples settled out after 1-hour).

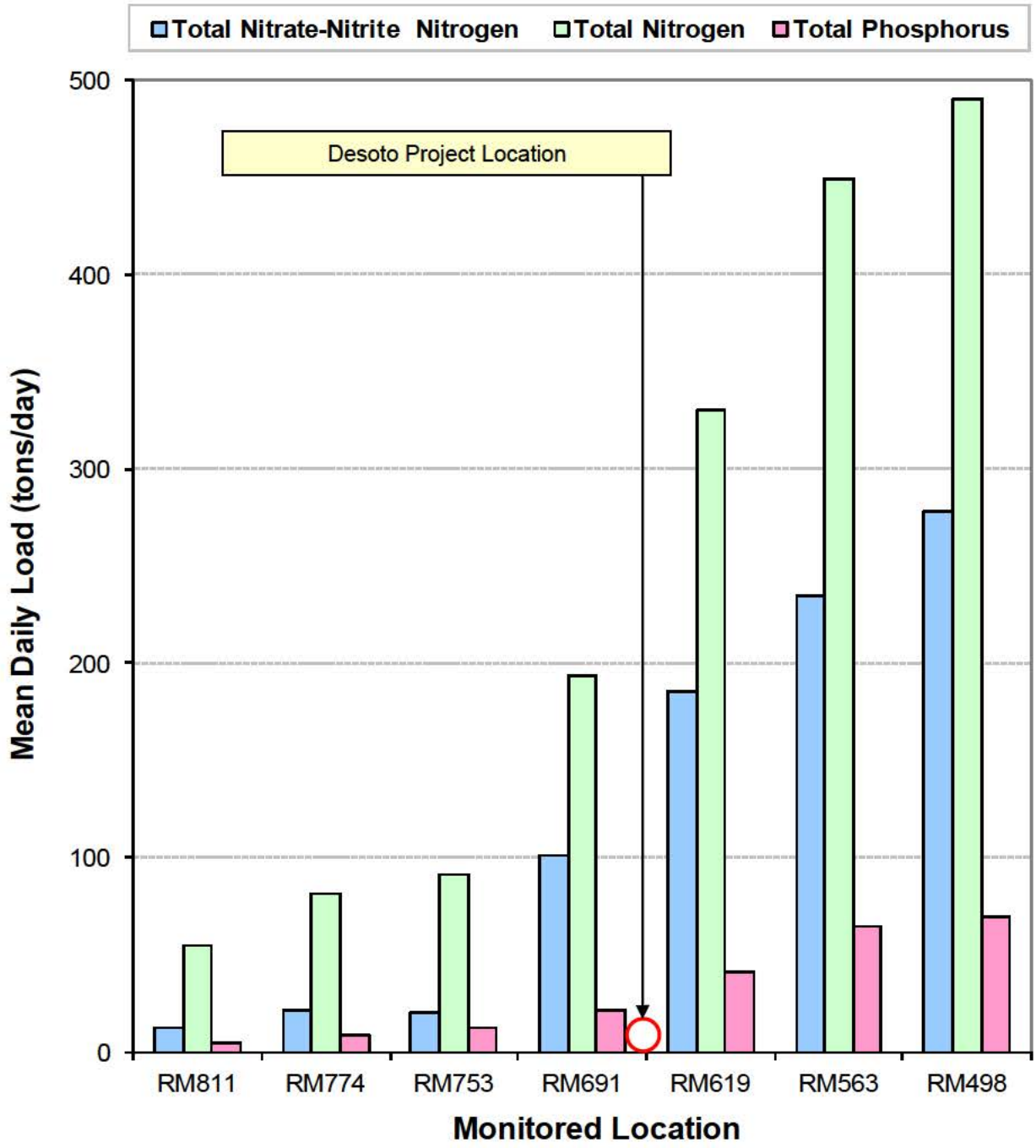

Figure 7. Mean daily loads for Total Nitrogen, Nitrate-Nitrite Nitrogen, and Total Phosphorus based on monthly monitoring along the Missouri River from Gavins Point Dam to Rulo, Nebraska over the 5-year period 2007 through 2011.

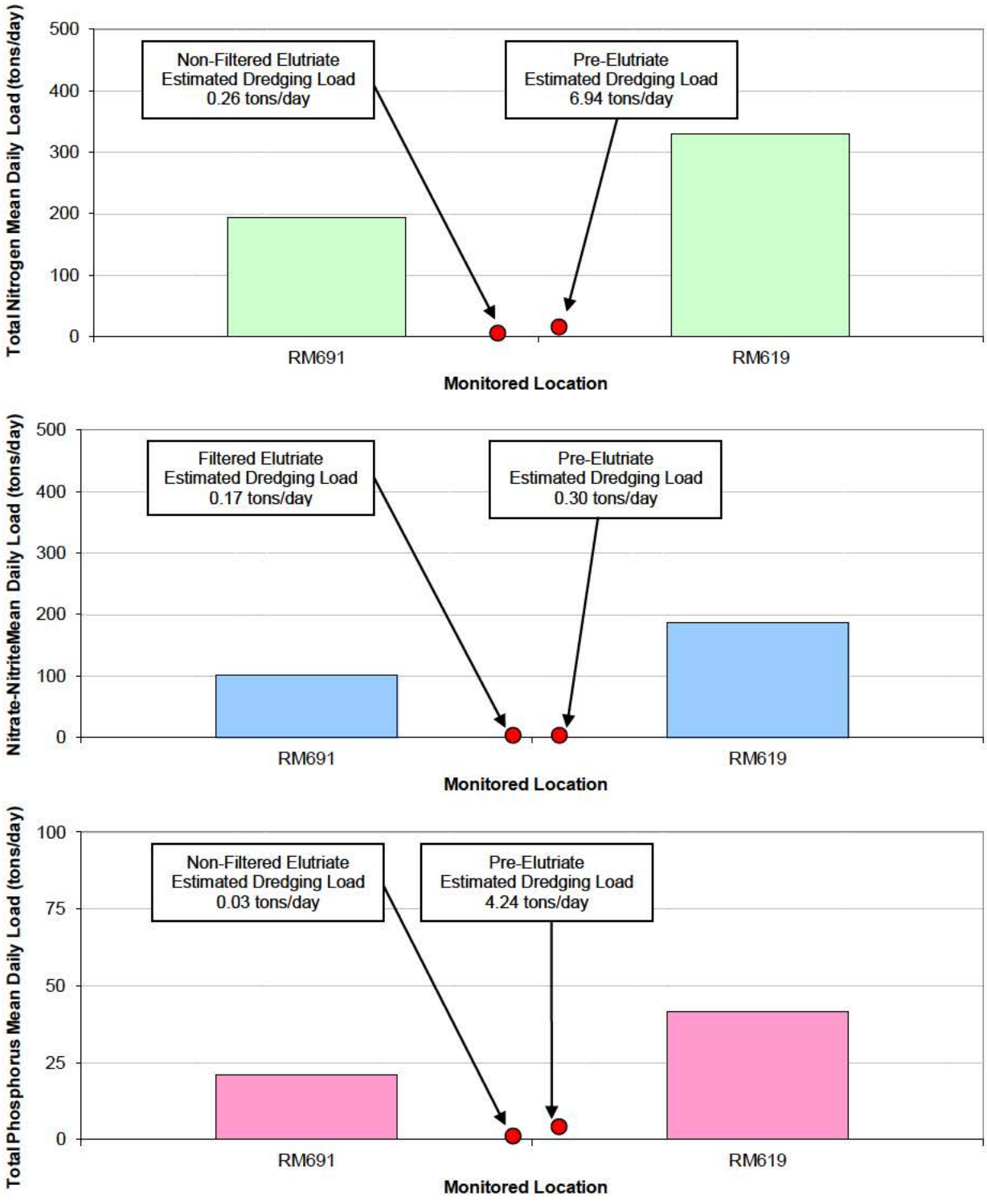

Figure 8. Comparison of estimated Total Nitrogen, Nitrate-Nitrite Nitrogen, and Total Phosphorus daily loadings from hydraulic dredging discharge to construct proposed shallow-water habitat at the Desoto project site to mean daily loadings calculated for the Missouri River at RM691 and RM619 over the 5-year period 2007 though 2011.

5.4 Proposed Disposal Site Determinations

Mixing zone provisions for water quality standards application typically apply to contaminants released from a point source discharge. State water quality standards appropriately define acute and chronic numeric criteria for contaminants. Mixing zones are meant to provide water quality protection to a waterbody receiving a point source discharge, while at the same time allowing the discharge to initially mix and disperse within the receiving waterbody. Generally, mixing zones include both "acute" and "chronic" zones of mixing. Acute mixing zones (exceedance of acute criteria) are more restricted and typically must allow for a zone of passage for aquatic life and are not to extend across public drinking water supply intakes, heavily used recreation areas, mouths of tributary streams, etc. Chronic mixing zones (exceedance of chronic criteria) are less restrictive in that a zone of passage is typically not required, but they also typically are not to extend across public drinking water supply intakes and heavily used recreation.

The Section 404(b)(1) Guidelines, at §230.11(f), allow for mixing zones. Mixing zones for dredge and fill discharges are to be confined to the smallest practicable zone that is consistent with the type of dispersion determined to be appropriate. The following factors are identified in §230.11(f) for consideration in determining the acceptability of a proposed mixing zone:

- Depth of water at the disposal site;
- Current velocity, direction, and variability at the disposal site;
- Degree of turbulence;
- Stratification attributable to causes such as obstructions, salinity or density profiles at the disposal site;
- Rate of discharge;
- Ambient concentration of constituents of interest;
- Dredged material characteristics, particularly concentrations of constituents, amount of material, type of material (sand, silt, clay, etc.) and settling velocities;
- Number of discharge actions per unit of time; and
- Other factors of the disposal site that affect the rates and patterns of mixing.

Elutriate testing of the collected sediment/soil samples at the proposed Desoto project site indicated that all assessed constituents, except Cadmium and Selenium, met applicable acute and chronic Iowa and Nebraska numeric water quality standards criteria. Nebraska's chronic criteria for Cadmium and Selenium were exceeded by one filtered elutriate sample. Pre-elutriate testing indicated potentially elevated total metals levels that could be problematic regarding Nebraska's Public Drinking Water Supply standards – there are no drinking water intakes in the immediate vicinity of the proposed dredging discharge at the Desoto project site. Since a "regulated" mixing zone is not needed to ensure compliance with acute aquatic life water quality criteria and no drinking water supply intakes are in the immediately vicinity of the proposed dredging discharge, it's assumed complete mixing of the dredging discharge with the flow in the Missouri River is appropriate in evaluating potential impacts to existing water quality pursuant to State and Federal antidegradation provisions. It is assumed antidegradation provisions would apply at the edge of a permitted mixing zone.

5.4.1 Completely Mixed Conditions

Impacts of the proposed dredging discharge on existing water quality in the Missouri River was evaluated after consideration was given for complete mixing of the dredging discharge with the long-term mean flow in the Missouri River. This was accomplished by calculating a flow-weighted average concentration for a water quality constituent based on flow and constituent concentration in the Missouri River and dredging discharge. The average mean daily flow of the Missouri River at Omaha, Nebraska was determined from USGS flow records (USGS gauge 06610000). The average mean daily flow of the Missouri River at Omaha (period of record 1967 -2012) was determined to be 36,298 cfs (range = 5,460 – 212,000 cfs; median = 34,100 cfs).

5.4.2 Existing Missouri River Water Quality

Since 2003, the District has monitored water quality conditions monthly at seven locations along the Missouri River from the Gavins Point Dam tailwaters to Rulo, Nebraska. Constituents monitored monthly include Chemical Oxygen Demand, Total Organic Carbon, Total Kjeldahl Nitrogen, Ammonia, Nitrate-Nitrite, Total Nitrogen, Total Phosphorus, and Dissolved Phosphorus. The elutriate testing results of the sediment/soil collected at the proposed Desoto project site were compared (plotted) to the ambient water quality conditions monitored in the Missouri River at Rulo, NE over the 5-year period 2007 through 2011 (Figures 9 - 16). Calculation of completely mixed conditions was applied to the estimated pre-elutriate results for Total Organic Carbon, Total Kjeldahl Nitrogen, and Total Phosphorus; and monitored Missouri River water quality conditions over the 10-year period (2003 - 2012). Table 21 summarizes the calculation of completely mixed conditions for Total Organic Carbon, Total Nitrogen, and Total Phosphorus.

Table 21. Completely mixed, flow-weighted conditions for estimated pre-elutriate concentrations of Total Organic Carbon, Total Kjeldahl Nitrogen and Total Phosphorus.

Water Quality Constituent	Missouri River		Dredging Discharge		Completely Mixed Concentration
	Average Flow (cfs)	Average Concentration	Design Flow (cfs)	Average Pre-Elutriate Concentration	
Carbon, Total Organic (mg/L)	36,298	4.5	43.6	1,414	6.2
Nitrogen, Kjeldahl Total as N (mg/L)	36,298	1.06	43.6	113	1.2
Phosphorus, Total (mg/L)	36,298	0.27	43.6	72.2	0.36

5.5 Summary of Water Quality Factual Determinations

- Elutriate testing of the collected sediment/soil samples at the proposed Desoto project site indicated that all assessed constituents, except Cadmium and Selenium, met applicable acute and chronic numeric water quality standards criteria. Nebraska's chronic criteria for Cadmium and Selenium were exceeded by one dissolved elutriate sample. Elutriate testing results were for both dissolved and non-filtered elutriate sample analyses prepared in accordance with the *"Inland Testing Manual"*.
- The proposed dredging discharge at the Desoto SWH project site would likely have only minor, short-term impacts to the existing water quality of the Missouri River; especially after complete mixing is achieved in the river. Based on analyzed water quality constituents, only minor increases in constituent concentrations, within the natural variability of water quality in the Missouri River, are indicated.
- The dredging discharge to construct SWH at the proposed Desoto project site could cause a slight increase to the nutrient loading currently present in the Missouri River at the project site. It is estimated that the mean daily suspended load for Total Kjeldahl Nitrogen could be increased by 6.4%, the mean daily suspended load for Nitrate-Nitrite Nitrogen could be increased by 0.09%, and the mean daily suspended load for Total Phosphorus could be increased by 16.1%. It is noted that the 16.1% increase in the suspended Total Phosphorus loadings is a worst-case estimate. Some of the suspended Total Phosphorus load is bound to particulate matter that will settle and become incorporated into the bed-load of the Missouri River. The bed-load Total Phosphorus loading is in addition to the suspended Total Phosphorus loading estimated in this report. As indicated by elutriate testing results, the estimated mean suspended Total Phosphorus concentration of 72.2 mg/L (pre-elutriate) could decrease to 0.46 mg/L (non-filtered elutriate) after 1-hour of settling time (i.e. 99.4% of the total phosphorus present in the pre-elutriate samples settled out after 1-hour).

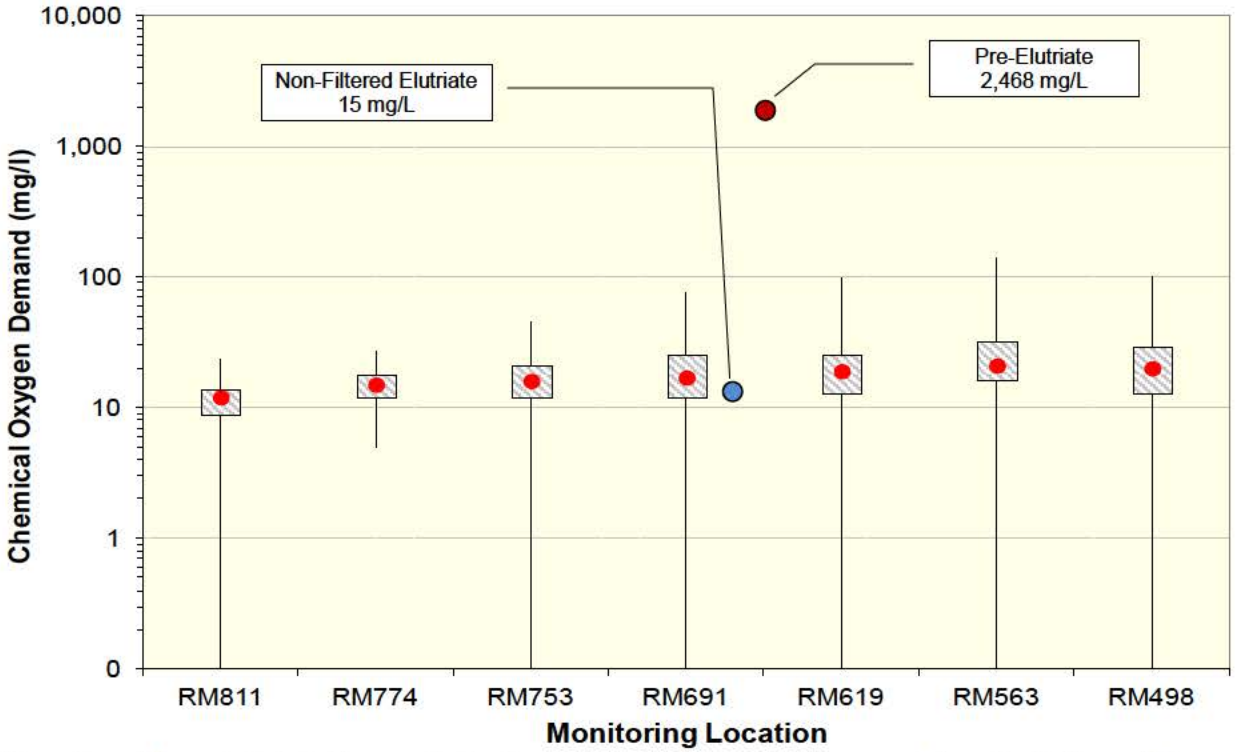

Figure 9. Mean elutriate testing results for Chemical Oxygen Demand as compared to ambient Missouri River conditions monitored over the 5-year period 2007 through 2011. Box plot displays minimum and maximum (whiskers) and inter-quartile range, red dot is the median value.

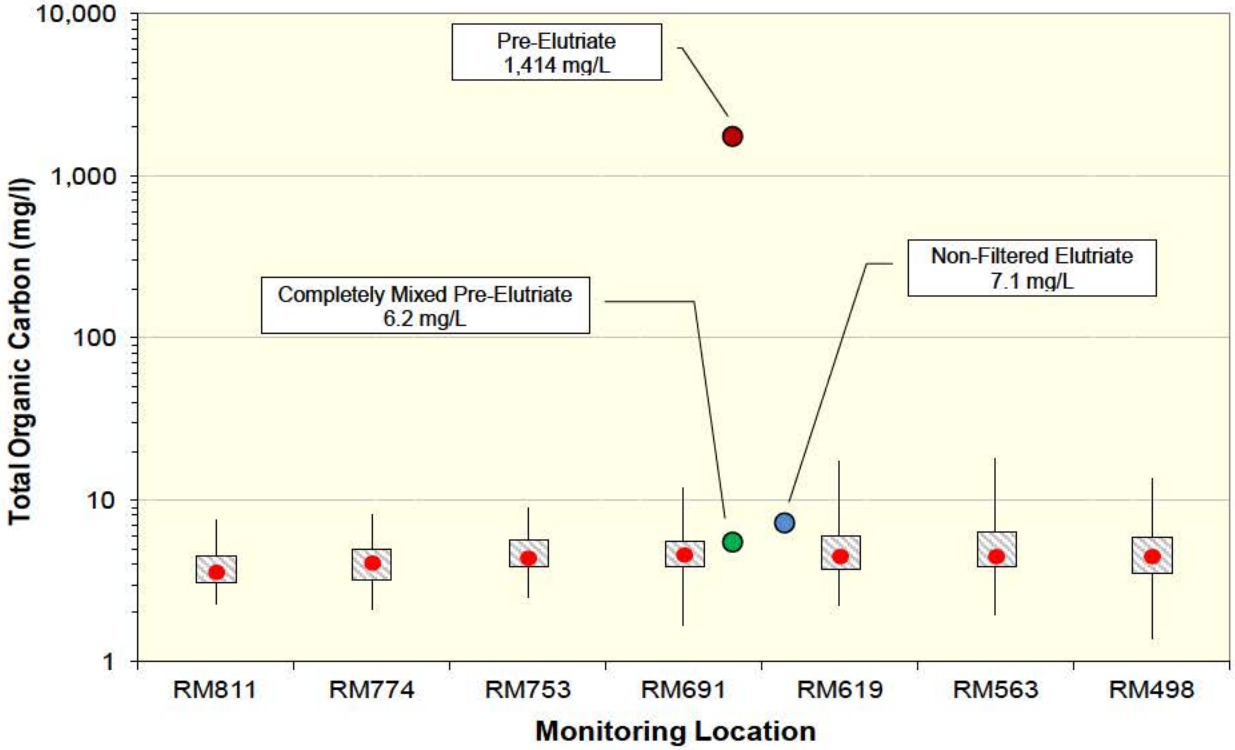

Figure 10. Mean elutriate testing results for Total Organic Carbon as compared to ambient Missouri River conditions monitored over the 5-year period 2007 through 2011.

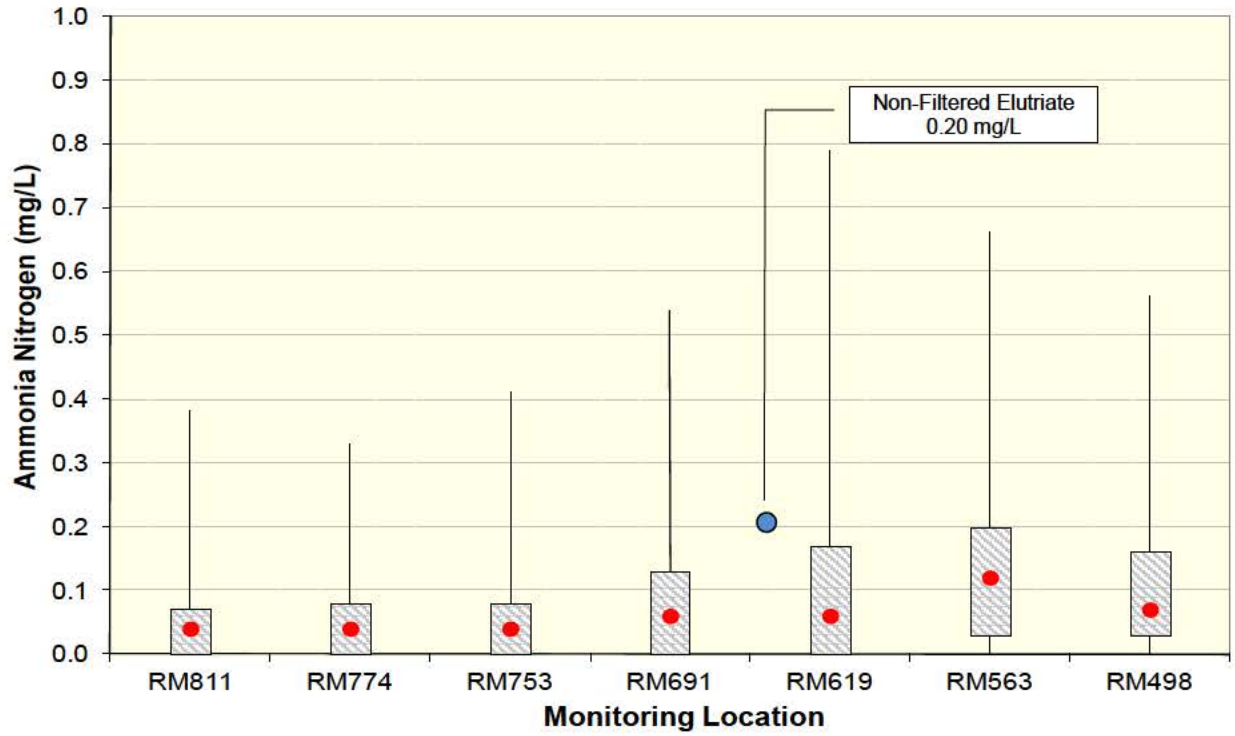

Figure 11. Mean elutriate testing results for Ammonia as compared to ambient Missouri River conditions monitored over the 5-year period 2007 through 2011.

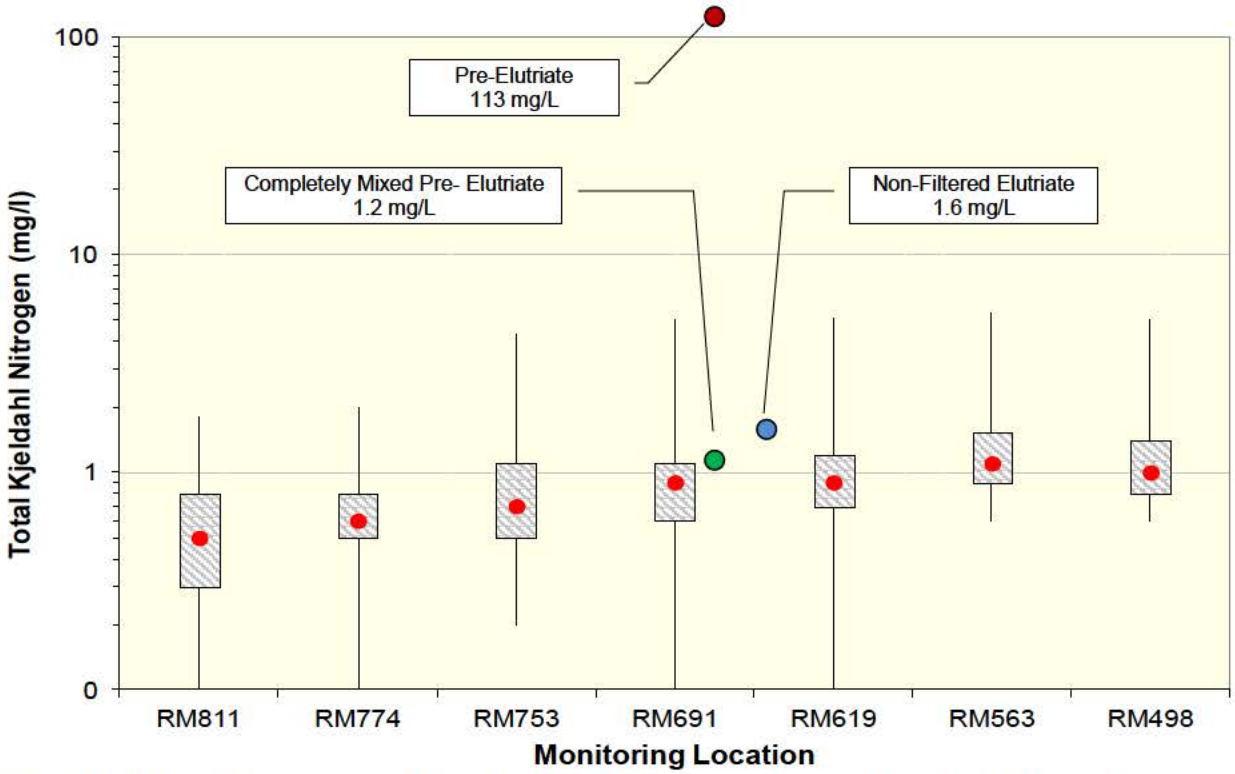

Figure 12. Mean elutriate testing results for Total Kjeldahl Nitrogen as compared to ambient Missouri River conditions monitored over the 5-year period 2007 through 2011.

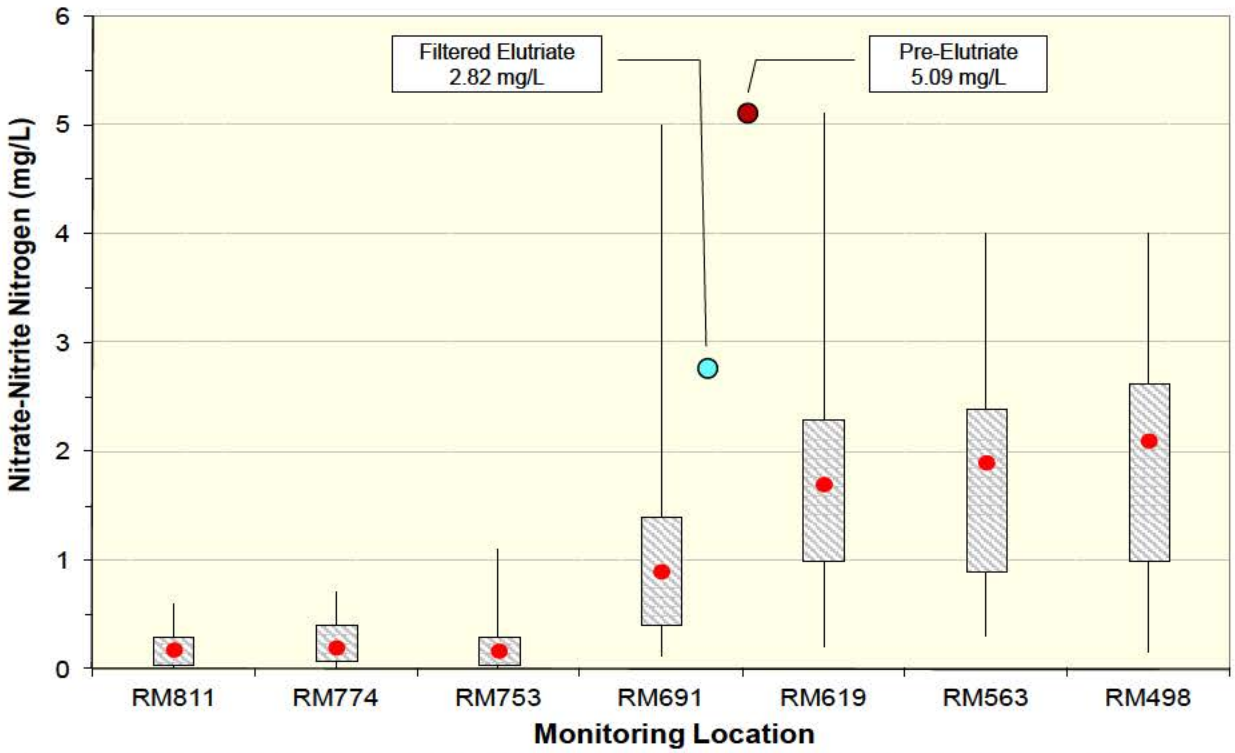

Figure 13. Mean elutriate testing results for Nitrate-Nitrite Nitrogen as compared to ambient Missouri River conditions monitored over the 5-year period 2007 through 2011.

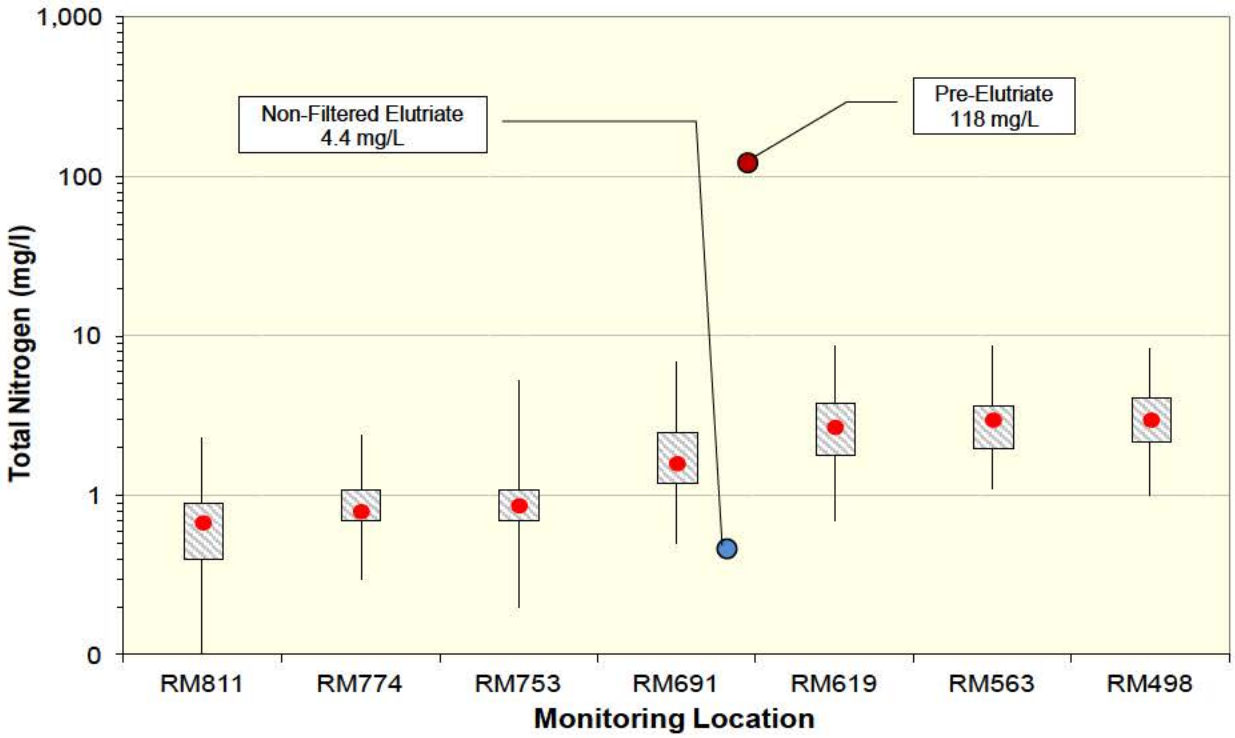

Figure 14. Mean elutriate testing results for Total Nitrogen as compared to ambient Missouri River conditions monitored over the 5-year period 2007 through 2011.

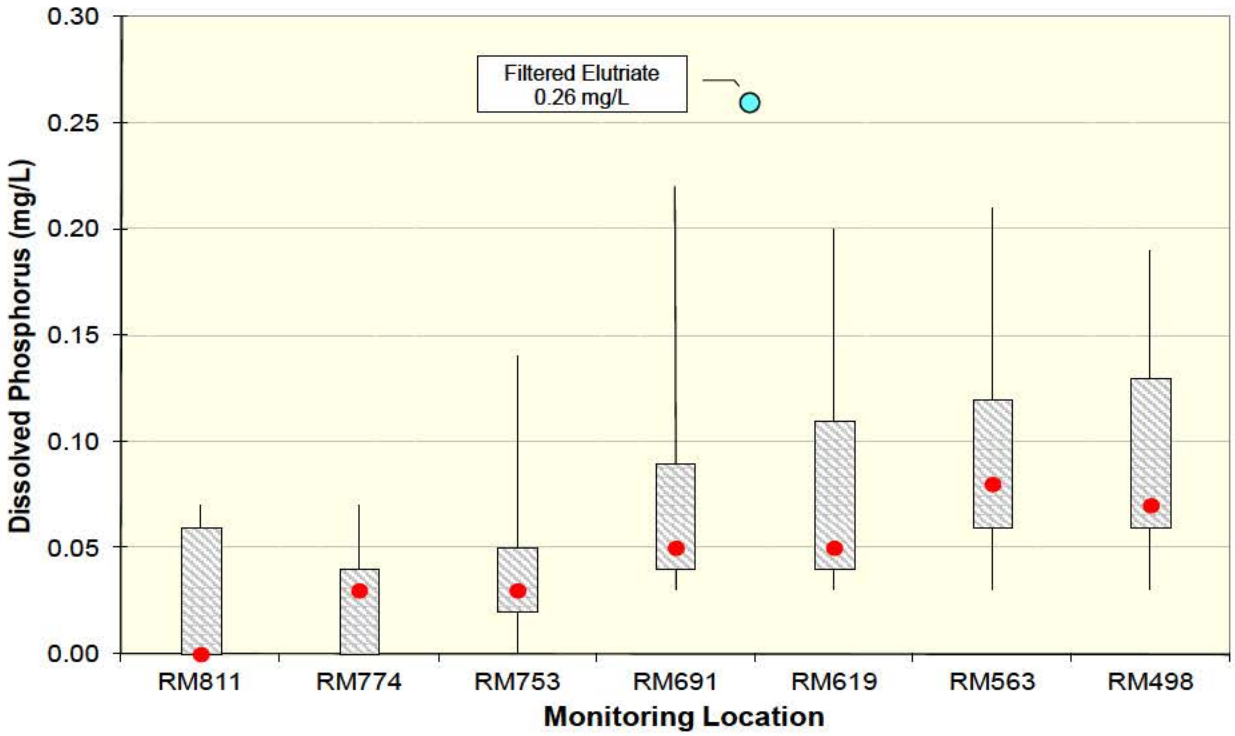

Figure 15. Mean elutriate testing results for Dissolved Phosphorus as compared to ambient Missouri River conditions monitored over the 5-year period 2007 through 2011.

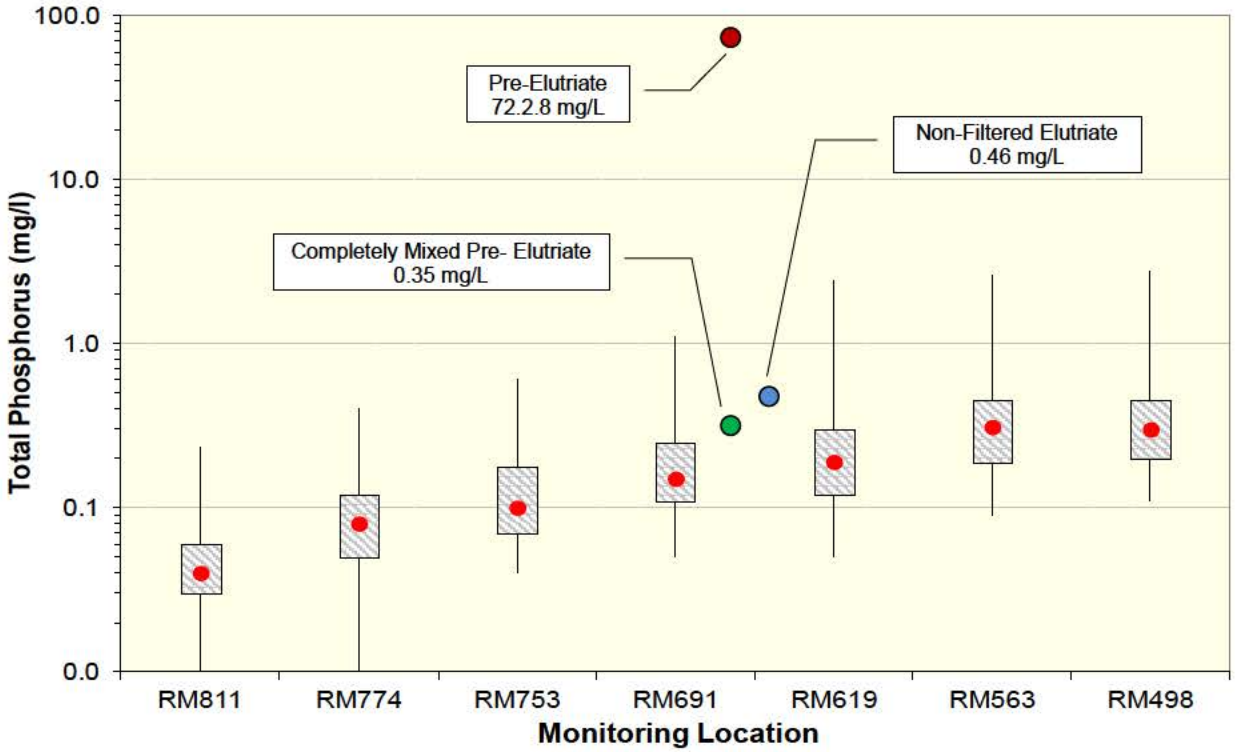

Figure 16. Mean elutriate testing results for Total Phosphorus as compared to ambient Missouri River conditions monitored over the 5-year period 2007 through 2011.

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ATTACHMENT 1.

Quality Control Plan for 2013 Elutriate Testing at the Proposed Desoto Shallow Water Habitat Site

QUALITY CONTROL PLAN

for

2013 Elutriate Sampling – Missouri River
Desoto SWH Project Area

Project Number: SPS-DESOTO-001

Prepared By:

Water Control and Water Quality Section
Hydrologic Engineering Branch
U.S. Army Corps of Engineers – Omaha District

May 2013

USACE – Water Quality Unit Sampling Coordinator	14-May-13 Date
USACE – Water Quality Unit Team Leader	14-May-13 Date
USACE – Chief, Water Control and Water Quality Section	14 May 13 Date
USACE – Chief, Sedimentation & Channel Stabilization Section	14-May-13 Date
USACE – (CENWO-PM-AE)	14-May-13 Date

Distribution List:

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Dave Jensen (Water Quality Unit)
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Dan Pridal (Sedimentation & Channel Stabilization Section)

U.S. Army Corps of Engineers – Omaha District – (CENWO-PM-AE)

Luke Wallace
David Crane

TABLE OF CONTENTS

Page

1. PROJECT DESCRIPTION

1.1. BACKGROUND INFORMATION

Shallow water habitat (SWH) will be constructed along the Missouri River at RM644 as part of the Desoto Bend project. The District plans to expand and enhance backwater at the project site. The removal of sediment/soil will involve hydraulic dredging and it is proposed that the dredge spoil be discharged to the adjacent Missouri River. It is believed the sediment is alluvial material and will be primarily sand with some silts and clays.

1.1.1. Project Location

The proposed Desoto project site is located along the Missouri River at RM644 just east of the Desoto Bend National Wildlife Refuge (Figure 1). The proposed project site is on the Nebraska side of the Missouri River but within Harrison County of the State of Iowa (Figure 2). Figure 2 indicates the proposed areas to be excavated at the Desoto project site.

1.1.2. 404 Permitting Requirements

The requirements for a U.S. Army Corps of Engineers (USACE) individual Section 404 permit must be met for the proposed dredging activity. To meet the Section 404 Individual Permit requirements, a Section 401 Certification "letter" will be requested from the Iowa Department of Natural Resources (IDNR) stating that the proposed actions will not "violate" State water quality standards. To facilitate review of the proposed project for Section 401 Certification, "elutriate testing" of sediment/soil collected from the proposed dredging site will be conducted. This monitoring project plan was developed to collect the appropriate samples for elutriate testing pursuant to the U.S. Environmental Protection Agency (USEPA) and USACE guidance document, "Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. – *Inland Testing Manual"* (USEPA and USACE, 1998).

2. PROJECT/TASK ORGANIZATION AND RESPONSIBILITIES

The Omaha District's Water Control and Water Quality Section will conduct the sampling required to facilitate elutriate testing of prospective dredge material in the project area. Collected samples will be delivered to Midwest Laboratories, Inc. Omaha, NE for preparation and analysis of elutriate samples.

Staff Responsibilities and Contacts for Sampling:
Sample Collection: Dave Jensen (995-2310), Bill Otto (995-2313), John Hargrave (995-2347)
Sampling Coordination: Dave Jensen
Data Quality Review: Dave Jensen
Water Quality Sampling Report: Dave Jensen
Laboratory Analysis: Midwest Laboratories, Prem Arora (402-829-9878)
Desoto SWH Project Coordinator: David Crane

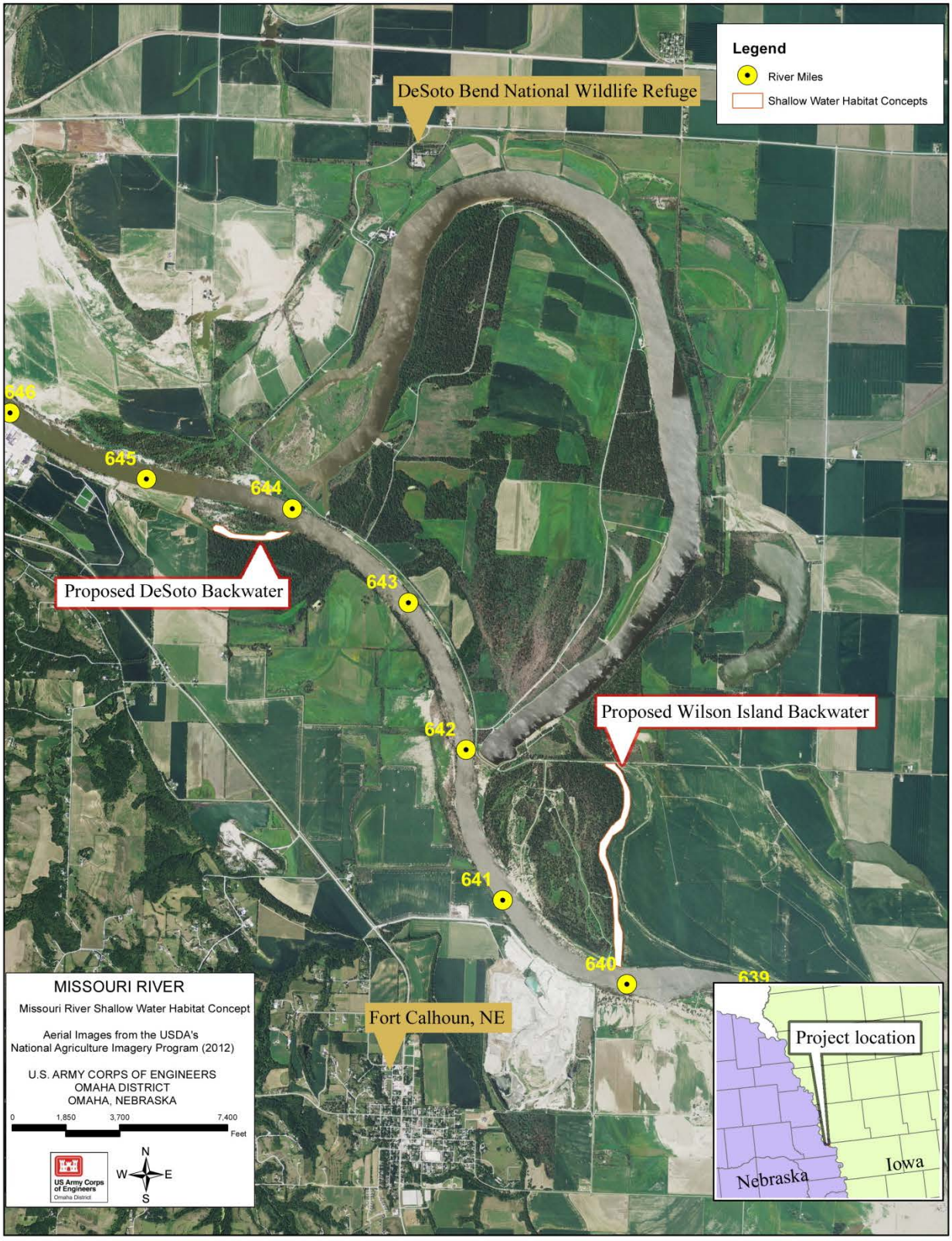


Figure 1. Location of proposed Desoto backwater project site.

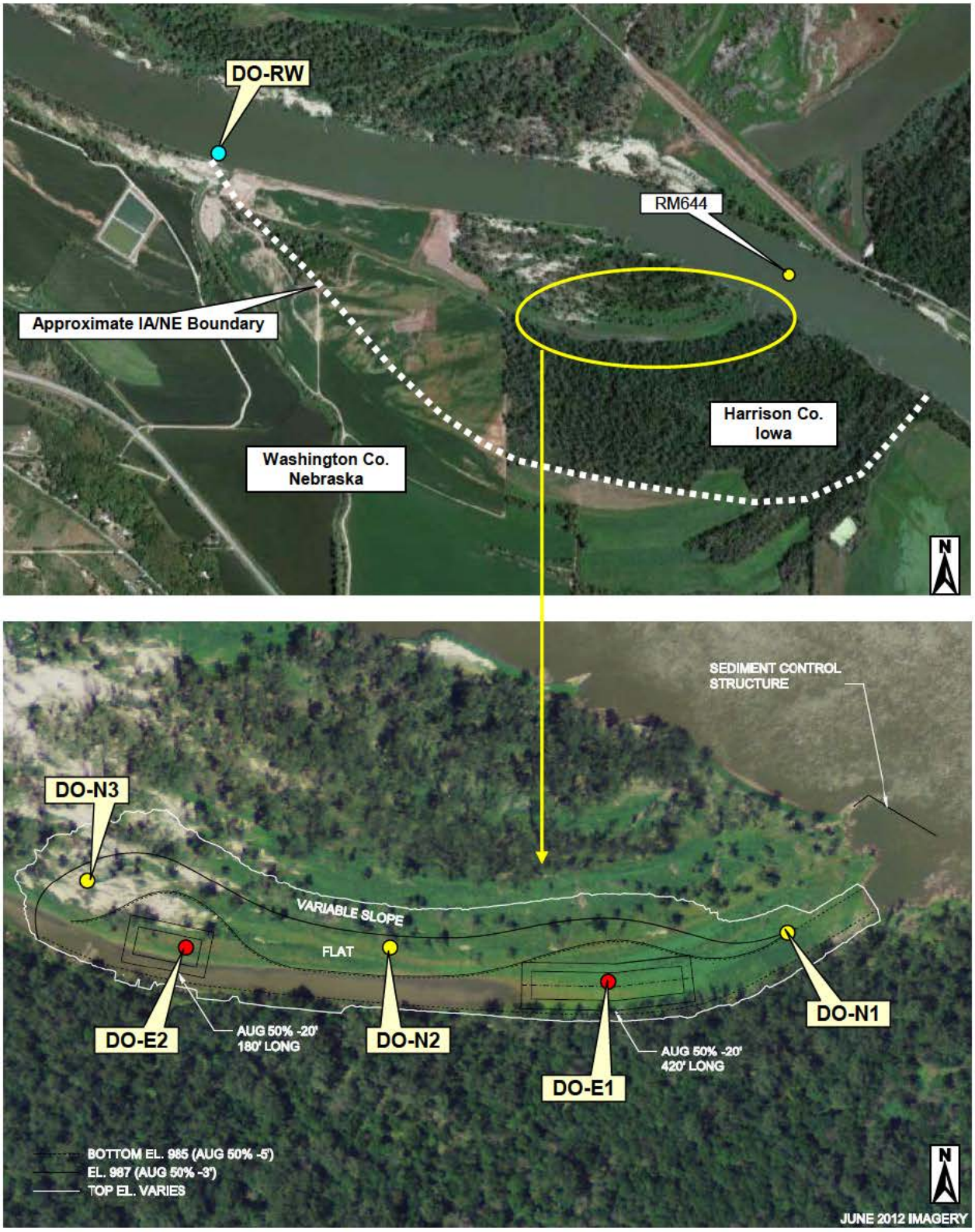


Figure 2. Proposed area for excavation to enhance and expand the existing backwater at the Desoto project site. *(Shown on June 2012 Google Earth imagery.)*

3. SITE-SPECIFIC WATER QUALITY CONCERNS

3.1. SECTION 303(D) IMPAIRED WATERS LISTINGS

Iowa has not listed the Missouri River at the location of the proposed Desoto project as impaired pursuant to Section 303(d). Nebraska's 2012 303(d) list does identify the Missouri River at the location of the Wilson Island project as impaired.

Nebraska's water quality standards identify the Missouri River from the Big Sioux River to the Platte River as designated Segment MT1-10000. Segment MT1-10000 is listed on Nebraska's 2012 Section 303(d) list as impaired due to a fish consumption advisory. The identified parameters of concern are Cancer Risk & Hazard Index Compounds, specifically, Dieldrin and PCBs. After the Nebraska Department of Environmental Quality (NDEQ) published their 2012 Integrated Water Quality Report and Section 303(d) list on 1-April-2012 that listed Segment MT1-10000 as impaired due to the fish consumption advisory in effect, the NDEQ published the report, "Findings of the 2010 Regional Ambient Fish Tissue Program in Nebraska" in June, 2012 (NDEQ, 2012). That report indicated that Dieldrin and PCBs were no longer a fish tissue concern on Segment MT1-10000. This resulted in the fish consumption advisory for the Missouri River regarding Dieldrin and PCBs being removed. Based on the removal of the fish consumption advisory for the Missouri River, the NDEQ has indicated that the 303(d) listing of the Missouri River for Dieldrin and PCBs will be removed in the next published 303(d) listing (personal communication NDEQ). As such, the Missouri River in the area of the proposed Desoto project site will not be identified as impaired from Cancer Risk & Hazardous Index Compounds (i.e. Dieldrin and PCBs) by Nebraska's next 303(d) list of impaired waters. Personnel communication with NDEQ has indicated that elutriate testing for Dieldrin and PCBs to a detection limit of 0.4 parts-per-trillion is no longer required.

3.2. NUTRIENTS

Concerns have been expressed regarding the nutrient enrichment and loading that the proposed dredging for SWH construction might pose to the Missouri River and ultimately to the Gulf of Mexico. Currently, no numeric water quality standards criteria have been promulgated by the States of Nebraska or Iowa for the Missouri River regarding nutrient enrichment. The State of Iowa has recently released the draft document, "*Iowa Nutrient Reduction Strategy – A science and technology-based framework to assess and reduce nutrients to Iowa waters and the Gulf of Mexico"* (IDALSW et. al, 2012). The Iowa strategy follows the recommended framework provided by EPA in 2011, and is only the second state to complete a statewide nutrient reduction strategy. The Iowa Nutrient Reduction Strategy is a science and technology-based framework to assess and reduce nutrients to Iowa waters and the Gulf of Mexico. It is designed to direct efforts to reduce nutrients in surface water from both point and nonpoint sources in a scientific, reasonable, and cost-effective manner. The Iowa strategy proposes a pragmatic, strategic and coordinated approach for reducing nutrient loads discharged from the state's largest wastewater treatment plants, in combination with targeted practices designed to reduce loads from nonpoint sources now while evaluating the future need for nutrient water quality standards.

For background information, nutrient analysis will be included in the elutriate testing of sediment/soil samples collected at the proposed Desoto project site.

4. DATA QUALITY OBJECTIVES

A Water Quality Sampling Report and Factual Determinations will be prepared that compiles results of the elutriate testing of representative sediment/soil samples collected at the Desoto project site, and assesses the water quality impacts the proposed hydraulic dredging at the project site poses to the Missouri River. The report will be provided to the IDNR to facilitate appropriate Section 401 water quality certification review of the proposed dredging project by the State of Iowa. The report will also be provided to the NDEQ for informational use, and will be used by the Omaha District to finalize the dredging plan for construction of SWH at the proposed Desoto project site.

5. DATA COLLECTION APPROACH

5.1. SAMPLING LOCATIONS

Sediment/soil samples will be collected at 5 sites: DO-E1, DO-E2, DO-N1, DO-N2, and DO-N3 (Table 1). The locations of the two sediment/soil sampling sites are shown in Figure 2. Receiving water (Missouri River) samples will be collected at the project location at site DO-RW (Figure 2). The "actual" locations of the sampled sites will be determined with a GPS unit in the field when the samples are collected (Attachment 1).

Table 1. Geo-referenced locations of sediment/soil sampling sites at the proposed Desoto shallow-water habitat project site.

Site	Latitude	Longitude
DO-E1	41° 30' 43.2"	96° 02' 42.5"
DO-E2	41° 30' 43.7"	96° 02' 57.6"
DO-N1	41° 30' 44.5"	96° 02' 35.8"
DO-N2	41° 30' 43.8"	96° 02' 51.3"
DO-N3	41° 30' 44.9"	96° 03' 01.0"

5.2. MEASUREMENT AND SAMPLING METHODS

5.2.1. Receiving Water Sample

Water collected from the Missouri River near the project site (i.e., receiving water) will be used for elutriate testing. The laboratory requires 4 parts receiving water for each 1 part of soil/sediment to be analyzed. In addition to the 4 parts of water for each 1 part soil/sediment, additional receiving water is required for analysis. The receiving water will be collected at the project location at site DO-RW (Figure 2).

At the time the receiving water is collected, the following field measurements will be taken: water temperature, dissolved oxygen (mg/L and % saturation), pH, specific conductance, and turbidity. These measurements will be obtained with a "HydroLab" equipped with a MS5 DataSonde and Surveyor data logger. Measurements will be taken by immersion of the DataSonde directly into the river. Measurements will be appropriately recorded on a field sheet (Attachment 1).

5.2.2. Sediment/Soil Samples

Sediment/soil samples will be collected at Sites DO-E1, DO-E2, DO-N1, DO-N2, and DO-N3. The equipment, supplies, and procedures to be used to collect the sediment/soil samples are as follows.

5.2.2.1. Equipment and Supplies

1) Gas powered auger head
2) Stainless steel coring device (sediment samples for elutriate testing)
3) Steel auger (sediment samples collected for nutrient analysis only)
4) Gasoline
5) 1-gallon wide-mouth glass jars
6) 1-gallon narrow-mouth glass jugs
7) Sample bottle labels
8) COC
9) Field Sheets
10) GPS device
11) 5-gallon buckets
12) Shovel
13) Miscellaneous tools to remove collected sediment from coring device (i.e., wood stakes, mallet, screwdriver, putty knife, etc.)
14) Scrub brush

5.2.2.2. Sediment/Soil Collection Procedure

1) Select sample site and record general information (including Latitude/Longitude) on the field sheet.
2) Remove any vegetation near the proposed boring site (2-3 foot diameter circle).
3) Set out equipment near the boring site making sure to keep extraneous material out of the sample collection bucket.
4) Attach the corer to the auger head, bore down and collect sample in approximately one-foot increments.
5) After each coring, detach the device from the gas auger, suspend the corer over the sample collection bucket and deposit the collected material into the 5-gallon collection bucket.
6) Heavy clays may require a screwdriver, hammer and/or wooden stake or other tools to remove the sample from the corer.
7) When all cores for one sediment/soil sample have been collected in the bucket, homogenize the contents and fill a 1-gallon, wide-mouth glass jar. Affixing the sample label to the jar prior to filling it with the sample ensures good adhesion.
8) Clean the coring device, tools and sample collection bucket between sample collections.
9) Deliver the samples and an analytical request form or chain-of-custody to the laboratory analyzing the samples.

5.2.3. Preparation of Elutriate Samples

Elutriate testing will been done on collected sediment/soil samples. The procedures that will be used to process collected sediment/soil samples for elutriate testing is depicted in Figure 4.

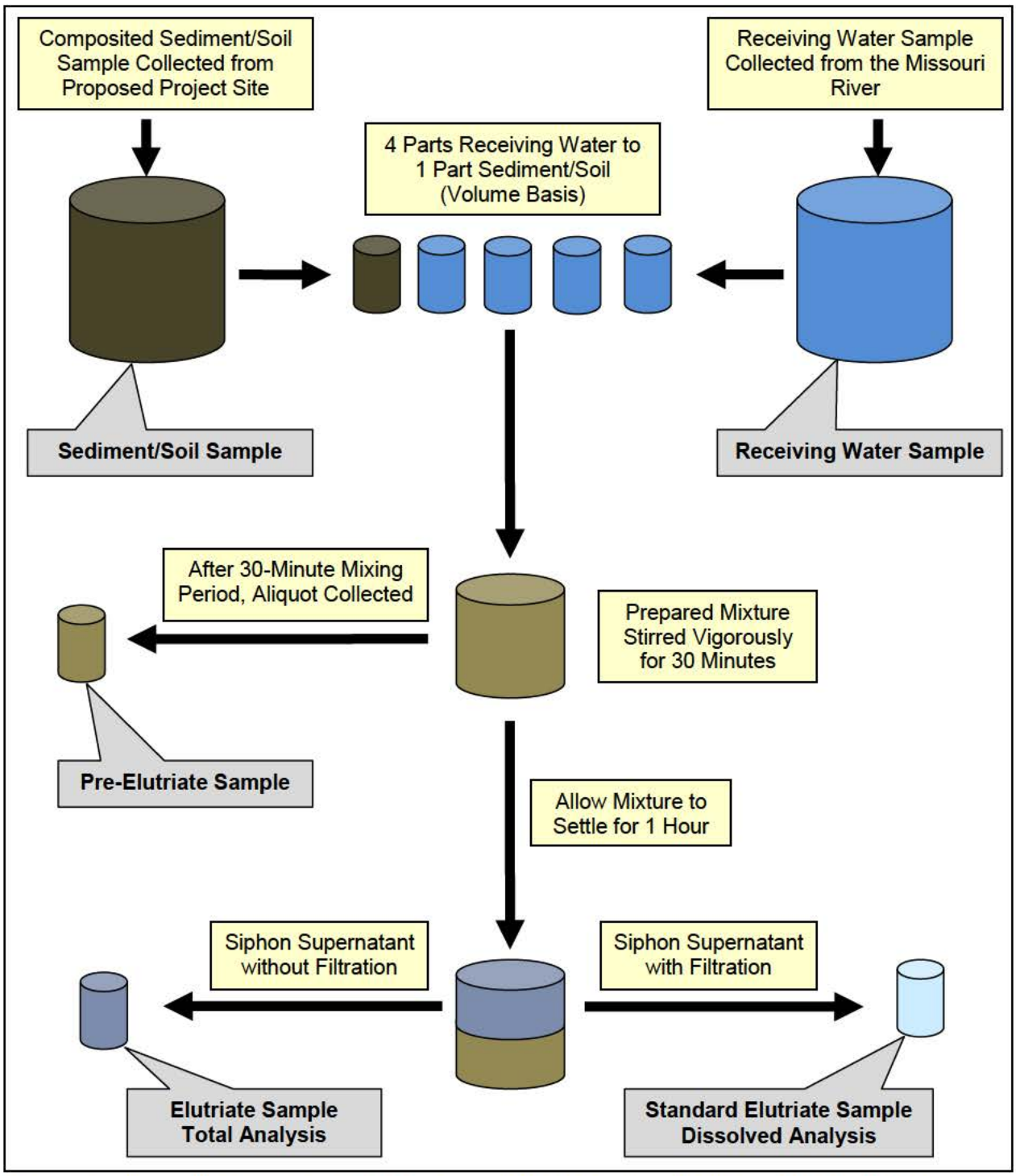


Figure 4. Procedures to be used to process collected sediment/soil samples for elutriate testing.

5.2.3.1. Standard Elutriate Samples

Standard elutriate samples will be prepared in accordance with the "*Inland Testing Manual*." Elutriate sample will be prepared by using receiving water collected from the Missouri River at site DO-RW. The sample is prepared in the laboratory by sub-sampling approximately

1-liter of the collected sediment/soil sample from the well-mixed original sample. The sediment material and unfiltered receiving water were then combined in a sediment-to-water ratio of 1:4 on a volume basis at room temperature (22 ± 2°C). The 1:4 sediment-to-water ratio is believed to represent "end-of-pipe" discharge conditions for hydraulic dredging**.** After the correct ratio is achieved, the mixture is stirred vigorously for 30 minutes with a mechanical stirrer/shaker. After the 30-minute mixing period, the mixture is allowed to settle for one hour. The supernatant is then siphoned off without disturbing the settled material. Analysis for total constituents is done on the supernatant without filtration, and the supernatant is filtered through a 0.45-micron filter for analysis of dissolved constituents. The filtered water is the standard elutriate sample identified by the *"Inland Testing Manual"* and represents the constituents that could be released from dredged material during the hydraulic dredging process.

5.2.3.2. Pre-Elutriate Samples

Pre-elutriate samples will be prepared for analysis of selected constituents. The pre-elutriate samples are prepared the same as standard elutriate samples through the point of the 30-minute mixing period. At that time an aliquot of water is immediately drawn off the mixed solution and identified as the pre-elutriate sample. The pre-elutriate sample is believed to represent conditions of the "end-of-pipe" hydraulic dredging discharge slurry prior to any mixing with the receiving water (i.e. Missouri River).

5.3. SAMPLE HANDLING, CUSTODY, AND TRANSPORT

The collected samples will be transported by sampling personnel to Midwest Laboratories, Inc. in Omaha, Nebraska for elutriate testing and analysis. A Chain-of-Custody (COC) will be completed and submitted with the samples delivered to the laboratory.

5.3.1. Sample Bottle Labels

Sample bottle labels will be provided by Midwest Laboratories. A spreadsheet will be provided to the contract laboratory that identifies the sites, parameters, bottle size, and preservatives for the samples to be collected. Midwest Laboratories will use the spreadsheet to prepare the necessary sample bottle labels and a COC.

5.3.2. Sample Handling, Transport, and Delivery to the Laboratory

Upon completion of sample collection, preservation, and labeling, those samples requiring chilling to 4° C should be stored in an iced cooler. Samples not requiring cooling can be stored by any convenient, but non-contaminable method. Samples are to be at all times stored in an upright condition. Samples will be transported by Water Quality Unit personnel directly Midwest Laboratories.

A COC will be completed and submitted with all samples delivered to Midwest Laboratories. Laboratory personnel should be alerted an appropriate time in advance of when samples are going to be delivered so any necessary arrangements for sample receipt by Midwest Laboratories can be made.

Samples delivered to Midwest Laboratories by Water Quality Unit personnel will be taken to a staging area and grouped by sample location. This will provide an accurate count of sample bottles delivered and allow for ease of log in by laboratory personnel. Laboratory personnel will compare the physical samples to information on the COC, sign and date the form,

and provide a copy. The original COC form will be retained by the laboratory. Once samples are logged-in they are to be maintained at 4° C until analysis is completed. Sample water is typically retained for at least 30 days beyond analysis.

5.4. PARAMETERS TO BE MEASURED

The parameters that will be measured or analyzed for the different types of samples are listed in Table 2.

Table 2. Parameters to be measured and analyzed.

Parameter	Soil Elutriate Testing	Soil Nutrient Analysis	Receiving Water	Pre-Elutriate Water	Elutriate Water	
					Non-Filtered	Filtered
FIELD MEASUREMENTS						
Water Temperature (°C)			X			
Dissolved Oxygen (mg/L and % Sat)			X			
pH (S.U.)			X			
Specific Conductance (µS/cm)			X			
Turbidity			X			
PHYSICAL AND AGGREGATE PROPERTIES						
Particle Size	X	X				
pH	X	X				X
Total Suspended Solids			X	X	X	
Turbidity				X	X	
NUTRIENTS						
Nitrogen, Ammonia as N	X	X	X	X	X	X
Nitrogen, Nitrate/Nitrite as N)	X	X	X	X		X
Nitrogen, Total Kjeldahl as N	X	X	X	X	X	
Phosphorus, Dissolved			X			X
Phosphorus, Orthophosphate			X			X
Phosphorus, Total	X	X	X	X	X	
AGGREGATE ORGANIC CONSTITUENTS						
CBOD			X	X	X	
Chemical Oxygen Demand			X	X	X	
Organic Carbon, Total	X	X	X	X	X	
METALS (Dissolved)						
Dissolved Metals Scan			X			X
METALS (Total)						
Total Metals Scan			X	X	X	
Arsenic, Total	X					
Cadmium, Total	X					
Chromium, Total	X					
Copper, Total	X					
Lead, Total	X					
Mercury, Total	X					
Nickel, Total	X					
Zinc Total	X					
PESTICIDES and PCBs						
Atrazine	X		X		X	
Organochlorine Pesticide/PCB Scan	X		X		X	

All collected sediment/soil samples (DO-E1, DO-E2, DO-N1, DO-N2, and DO-N3) will be analyzed for: Particle Size, pH, Ammonia, Nitrate/Nitrite, Total Kjeldahl Nitrogen, Total Phosphorus, and Total Organic Carbon (Table 2). Sediment/soil samples collected at sites DO-E1 and DO-E2 will also be analyzed for Total Metals Scan, Atrazine, and Organochlorine/PCB Scan (Table 2).

5.5. LABORATORY ANALYTICAL METHODS AND COSTS

Table 3 provides methods, detection limits, and costs for parameters to be analyzed on collected sediment/soil samples. Table 5 provides methods, detection limits, and costs for parameters to be analyzed on pre-elutriate samples. Table 7 provides methods, detection limits, and costs for parameters to be analyzed on standard filtered elutriate samples. Table 8 provides methods, detection limits, and costs for parameters to be analyzed on non-filtered elutriate samples. Table 10 provides methods, detection limits, and costs for parameters to be analyzed on receiving water.

Table. 3. Parameters to be Analyzed on Collected Sediment/Soil Samples and Unit Costs.

Parameter	Method	Detection Limit	Analytical Cost
PHYSICAL AND AGGREGATE PROPERTIES			
Particle Size	Sieve (Minimum Sieve #200)	0.001 mm	$60.00
pH	EPA 150.1	0.1 S.U.*	12.00
NUTRIENTS			
Nitrogen, Ammonia Total as N	EPA 350.1	0.02 mg/kg	17.70
Nitrogen, Kjeldahl Total as N	EPA 351.3	0.2 mg/kg	27.50
Nitrogen, Nitrate/Nitrite Total as N	EPA 353.2	0.02 mg/kg	13.00
Phosphorus, Total	SM4500PF	0.02 mg/kg	27.00
AGGREGATE ORGANIC CONSTITUENTS			
Total Organic Carbon	EPA 415.1	0.4 mg/kg	22.00
		Subtotal	**$179.20**
TOTAL METALS			
Arsenic, Total	EPA 6010B	10 mg/kg	12.75
Cadmium, Total	EPA 6010B	0.2 mg/kg	12.75
Chromium, Total	EPA 6010B	1 mg/kg	12.75
Copper, Total	EPA 6010B	1 mg/kg	12.75
Lead, Total	EPA 6010B	13 mg/kg	12.75
Mercury, Total	EPA 6010B	0.1 mg/kg	12.75
Nickel, Total	EPA 6010B	1 mg/kg	12.75
Zinc Total	EPA 6010B	2 mg/kg	12.75
PESTICIDES AND PCBs			
Atrazine, Total	EPA 507	0.05 mg/kg	150.00
Organochlorine Pesticide and PCB Scan	EPA 8081 and EPA 8082	See Table 4	180.00
		Subtotal	**$432.00**
		Total Laboratory Cost for Analyzing a Soil Sample	**$611.20**

* Resolution limit.

Table 4. Detection and Reporting Limits for individual parameters included in the Organochlorine Pesticide and PCB Scan of sediment/soil samples.

Parameter	Detection Limit (µg/kg)	Reporting Limit (µg/kg)	Parameter	Detection Limit (µg/kg)	Reporting Limit (µg/kg)
DDE	0.8	9.9	Alpha-BHC (alpha-Lindane)	0.4	5.1
DDD	0.7	9.9	Beta-BHC (beta-Lindane)	1.0	5.1
DDT	1.0	9.9	Delta-BHC (delta-Lindane)	1.8	5.1
Methoxychlor	1.2	5.1	Gamma-BHC (gamma-Lindane)	0.6	5.1
Aldrin	0.7	5.1	Gamma-Chlordane	0.8	5.1
Dieldrin	0.7	9.9	PCB - Aroclor1016	10	50
Endosulfan 1	0.7	5.1	PCB - Aroclor1260	10	50
Endosulfan 2	0.8	9.9	PCB - Aroclor1221	10	50
Endosulfan Sulfate	1.0	9.9	PCB - Aroclor1248	10	50
Endrin	1.0	9.9	PCB - Aroclor1268	10	50
Endrin Aldehyde	1.0	9.9	PCB - Aroclor1232	10	50
Endrin Ketone	0.8	9.9	PCB - Aroclor1254	10	50
Heptachlor	0.6	5.1	PCB - Aroclor1242	10	50
Heptachlor Epoxide	0.8	5.1	PCB - Aroclor1262	10	50
Alpha-Chlordane	0.8	5.1			

Table. 5. Parameters to be Analyzed in Pre-Elutriate Water Samples and Unit Costs.

Parameter*	Method	Detection Limit	Analytical Cost
SAMPLE PREPARATION			
Elutriate Sample Preparation	1:4 Sediment:Receiving Water	-----	$178.50
PHYSICAL AND AGGREGATE PROPERTIES			
Total Suspended Solids	EPA 160.1	5 mg/l	$10.90
Turbidity	EPA 180.1	1 NTU	13.50
NUTRIENTS			
Nitrogen, Ammonia as N,	EPA 350.1	0.02 mg/l	17.70
Nitrogen, Total Kjeldahl as N	EPA 351.3	0.2 mg/l	20.55
Nitrogen, Nitrate/Nitrite as N	EPA 353.2	0.02 mg/l	13.25
Phosphorus, Total	SM4500PF	0.02 mg/l	18.80
AGGREGATE ORGANIC CONSTITUENTS			
CBOD	SM 5210.B	1 mg/l	29.10
Chemical Oxygen Demand	ASTM D1252	3 mg/l	18.20
Organic Carbon, Total	EPA 415.1	0.4 mg/l	26.50
		Subtotal	**$347.00**
METALS			
Total Metals Scan	EPA 6010B	See Table 6	168.30
Total Laboratory Cost for Analyzing a Pre-Elutriate Water Sample			**$515.30**

Table 6. Detection and Reporting Limits for individual metals included in the Total and Dissolved Metals Scan of analyzed water samples.

Metal	Detection Limit (µg/l)	Reporting Limit (µg/l)	Metal	Detection Limit (µg/l)	Reporting Limit (µg/l)
Aluminum	20	50	Lead	0.5	2
Antimony	0.03	0.5	Magnesium	1,000	3,000
Arsenic	1	3	Manganese	2	10
Beryllium	0.2	1	Mercury	0.02	0.05
Cadmium	0.2	1	Nickel	2	10
Calcium	1,000	3,000	Selenium	0.4	1
Chromium III	4	10	Silver	0.05	1
Copper	2	10	Thallium	0.05	0.5
Iron	5	50	Zinc	2	10

Table 7. Parameters to be Analyzed in Standard Filtered Elutriate Water Samples and Unit Costs.

Parameter	Method	Detection Limit	Analytical Cost
PHYSICAL AND AGGREGATE PROPERTIES			
pH	EPA 150.1	0.1 S.U.*	7.45
NUTRIENTS			
Nitrogen, Ammonia as N	EPA 350.1	0.02 mg/l	17.70
Nitrogen, Nitrate/Nitrite as N (mg/l)	EPA 353.2	0.02 mg/l	13.35
Phosphorus, Dissolved	SM4500PF	0.02 mg/l	18.80
Ortho-Phosphorus, Dissolved	EPA 365.1	0.02 mg/l	14.30
METALS			
Dissolved Metals Scan	EPA 6010B	See Table 6	$168.30
Total Laboratory Cost for Analyzing a Standard Filtered Elutriate Water Sample			**$239.90**

* Resolution limit.

Table. 8. Parameters to be Analyzed in Non-Filtered Elutriate Water Samples and Unit Costs.

Parameter*	Method	Detection Limit	Analytical Cost
PHYSICAL AND AGGREGATE PROPERTIES			
Total Suspended Solids	EPA 160.1	5 mg/l	$10.95
Turbidity	EPA 180.1	1 NTU	13.55
NUTRIENTS			
Nitrogen, Ammonia as N	EPA 350.1	0.02 mg/l	17.70
Nitrogen, Total Kjeldahl as N	EPA 351.3	0.2 mg/l	20.55
Nitrogen, Nitrate-Nitrite as N	EPA 353.2	0.02 mg/l	13.25
Phosphorus, Total	SM4500PF	0.02 mg/l	18.80
AGGREGATE ORGANIC CONSTITUENTS			
CBOD	SM 5210.B	1 mg/l	29.15
Chemical Oxygen Demand	ASTM D1252	3 mg/l	18.20
Organic Carbon, Total	EPA 415.1	0.4 mg/l	26.55
METALS TOTAL			
Total Metals Scan	EPA 6010B	See Table 6	$168.30
PESTICIDES and PCBs			
Atrazine (Immunoassay by Elisa)	Fluorometry	0.1 μg/L	23.50
Organochlorine Pesticide and PCB Scan (ug/l)	EPA 8081 EPA 8082	See Table 9	180.00
Total Laboratory Cost for Analyzing a Pre-Elutriate Water Sample			**$540.50**

Table 9. Detection and Reporting Limits for individual parameters included in the Organochlorine Pesticide and PCB Scan of water samples.

Parameter	Detection Limit (μg/l)	Reporting Limit (μg/l)	Parameter	Detection Limit (μg/l)	Reporting Limit (μg/l)
DDE	0.005	0.1	Alpha-BHC (alpha-Lindane)	0.009	0.05
DDD	0.005	0.1	Beta-BHC (beta-Lindane)	0.009	0.05
DDT	0.004	0.1	Delta-BHC (delta-Lindane)	0.014	0.05
Methoxychlor	0.005	0.5	Gamma-BHC (gamma-Lindane)	0.035	0.05
Aldrin	0.008	0.5	Gamma-Chlordane	0.006	0.05
Dieldrin	0.004	0.1	PCB - Aroclor1016	0.2	1.0
Endosulfan 1	0.006	0.05	PCB - Aroclor1260	0.2	1.0
Endosulfan 2	0.003	0.1	PCB - Aroclor1221	0.2	2.0
Endosulfan Sulfate	0.010	0.1	PCB - Aroclor1248	0.3	1.0
Endrin	0.003	0.1	PCB - Aroclor1268	0.3	1.0
Endrin Aldehyde	0.011	0.1	PCB - Aroclor1232	0.2	1.0
Endrin Ketone	0.006	0.1	PCB - Aroclor1254	0.2	1.0
Heptachlor	0.009	0.05	PCB - Aroclor1242	0.2	1.0
Heptachlor Epoxide	0.007	0.05	PCB - Aroclor1262	0.2	1.0
Alpha-Chlordane	0.011	0.05			

Table 10. Parameters to be Analyzed on Receiving Water Sample and Unit Costs.

Parameter	Method	Detection Limit	Analytical Cost
PHYSICAL AND AGGREGATE PROPERTIES			
Total Suspended Solids	EPA 160.2	5 mg/l	10.90
NUTRIENTS			
Nitrogen, Ammonia as N, Total	EPA 350.1	0.02 mg/l	17.70
Nitrogen, Total Kjeldahl as N	EPA 351.3	0.2 mg/l	20.55
Nitrogen, Nitrate/Nitrite as N	EPA 353.2	0.02 mg/l	13.25
Phosphorus, Dissolved	SM4500PF	0.02 mg/l	18.80
Phosphorus, Total	SM4500PF	0.02 mg/l	18.80
Ortho-Phosphorus, Dissolved	EPA 365.1	0.02 mg/l	14.00
AGGREGATE ORGANIC CONSTITUENTS			
Carbonaceous Biochemical Oxygen Demand - CBOD (mg/l)	SM 5210.B	1 mg/l	29.10
Chemical Oxygen Demand	ASTM D1252	3 mg/l	18.20
Organic Carbon, Total	EPA 415.1	0.4 mg/l	26.50
METALS			
Dissolved Metals Scan	EPA 6010B	See Table 6	168.30
Total Metals Scan	EPA 6010B	See Table 6	168.30
PESTICIDES AND PCBs			
Organochlorine Pesticide and PCB Scan	EPA 8081 EPA 8082	See Table 8	180.00
Atrazine (Immunoassay by Elisa)	Fluorometry	0.1 μg/L	23.50
Total Laboratory Cost for Analyzing the Receiving Water Sample			**$727.90**

5.6. QUALITY CONTROL

5.6.1. Adherence to Standard Operating Procedures and Quality Control Plans

Where applicable, field measurements and samples will be collected in accordance with Standard Operating Procedures (SOP) developed by the Omaha District's Water Control and Water Quality Section.

Laboratory quality control samples and data quality indicators will be utilized in accordance with Midwest Laboratory's Quality Assurance Manual. Routine internal quality control checks are placed in the measurement system to assess the quality of the data generated. These checks typically include: with each preparative batch, a Method Blank, a Matrix Spike and Matrix Spike Duplicate, a Laboratory Duplicate, and a Laboratory Control Sample. Inclusion of the Matrix Spike, Matrix Spike Duplicate and Laboratory Duplicate are contingent on sufficient sample material being provided. In addition to the checks within the preparative batch there are analysis batch checks that are also completed (retained on file by the laboratory, but typically not reported in a standard data package) including Calibration Blanks, Initial Calibration Verifications, and Continuing Calibration Verifications. Additional samples are analyzed periodically (results retained on file) and may include reagent blanks, second source check standards and other performance checks. External quality control checks are provided in the form of Performance and System Audits and Surveillance. A laboratory Quality Assurance Report will be submitted to the District's Water Quality Unit on an appropriate basis.

5.6.2. Data Quality Review

All water quality measurements and analyses will be verified, validated, and compiled in accordance with SOP WQ-27202: Data Quality Review.

6. WATER QUALITY SAMPLING REPORT AND FACTUAL DETERMINATIONS

A Water Quality Sampling Report and Factual Determinations (WQSRFD) will be prepared that provides the results of the elutriate testing conducted on sediment/soil samples collected at the proposed Desoto project site. Elutriate testing results will be evaluated to assess potential impacts the proposed hydraulic dredging at the Desoto site poses to water quality and nutrient loading in the Missouri River. As appropriate, elutriate results will be:

1) Compared to applicable State water quality standards,
2) Evaluated for degradation of existing water quality conditions in the Missouri River, and
3) Compared to current nutrient loadings in the Missouri River.

The prepared WQSRFD will be subject to a "Peer Review/Report Check Certification" prior to release of the report to the public.

7. PROJECTED COSTS FOR LABOR AND LABORATORY ANALYSES

7.1. LABOR: $7,000

Water Control and Water Quality staff time for preparation of Quality Control Plan, Field Collection of identified samples, and preparation of a Water Quality Sampling Report.

7.2. LABORATORY ANALYSES (MIDWEST LABORATORIES): $6,120.30

Laboratory Analysis (Midwest Laboratories):

Analyzed Media	Number of Samples	Unit Cost per Sample	Total Cost
Soil Elutriate Testing (Sites DO-E1 and DO-E2)	2	$611.20	$1,222.40
Soil Nutrient Analysis (Sites DO-N1, DO-N2, DO-N3)	3	$179.20	$537.60
Pre-Elutriate – All Analysis	2	$515.30	$1,030.60
Pre-Elutriate – Nutrients	3	$347.00	$1,041.00
Filtered Elutriate	2	$239.90	$479.80
Non-Filtered Elutriate	2	$540.50	$1,081.00
Receiving Water	1	$727.90	$727.90
TOTAL ANALYTICAL COSTS			**$6,120.30**

8. REFERENCES

Iowa Department of Agricultural and land Stewardship, Iowa Department of natural Resources, and Iowa State University College of Agriculture and Life Sciences. 2012. Iowa Nutrient Strategy – A science and technology-based framework to assess and reduce nutrients to Iowa waters and the Gulf of Mexico. November, 2012. http://www.nutrientstrategy.iastate.edu/

Nebraska Department of Environmental Quality. 2012. Findings of the 2010 Regional Ambient Fish Tissue Program in Nebraska. June 2012. Water Quality Assessment Section, Nebraska Department of Environmental Quality, Lincoln, NE.

USEPA and USACE. 1998. Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. - Test Manual: Inland Testing Manual. EPA-823-B-98-004, February 1998. U.S. Environmental Protection Agency, Office of Water. Department of Army, U.S. Army Corps of Engineers. Washington, D.C

ATTACHMENT 1. Field Sheet for Desoto Elutriate Monitoring Project.

(U.S. Army Corps of Engineers – Omaha District – Water Quality Unit)

FIELD DATA SHEET

Project Name: Desoto Elutriate Monitoring **Project Number:** SPS-DESOTO-001

Trip Number: _____ **Date:** _____

Site Location: Desoto SWH Project, Missouri River (RM644)

Site Numbers: DO-E1**,** DO-E2, DO-N1, DO-N2, DO-N3, DO-RW

Collectors: _____

GPS MEASUREMENTS

GPS Device Used: _____

Site DO-E1: Latitude: _____ Longitude: _____

Site DO-E2: Latitude: _____ Longitude: _____

Site DO-N1: Latitude: _____ Longitude: _____

Site DO-N2: Latitude: _____ Longitude: _____

Site DO-N3: Latitude: _____ Longitude: _____

Site DO-RW2: Latitude: _____ Longitude: _____

WATER MEASUREMENTS

Water Quality Measurements:

Temp. (°C)	pH (S.U.)	Cond. (uS/cm)	D.O. (mg/L)	D.O. (%Sat)	Turbidity (NTUs)

SAMPLES COLLECTED

Sample Type	Sample ID	Sampled Depth	Collection Time	Sampling Method
Soil Sample	DO-E1			Composite Core
Soil Sample	DO-E2			Composite Core
Soil Sample	DO-N1			Composite Core
Soil Sample	DO-N2			Composite Core
Soil Sample	DO-N3			Composite Core
Water Sample	DO-RW	Surface		Grab

COMMENTS:

ATTACHMENT 2.

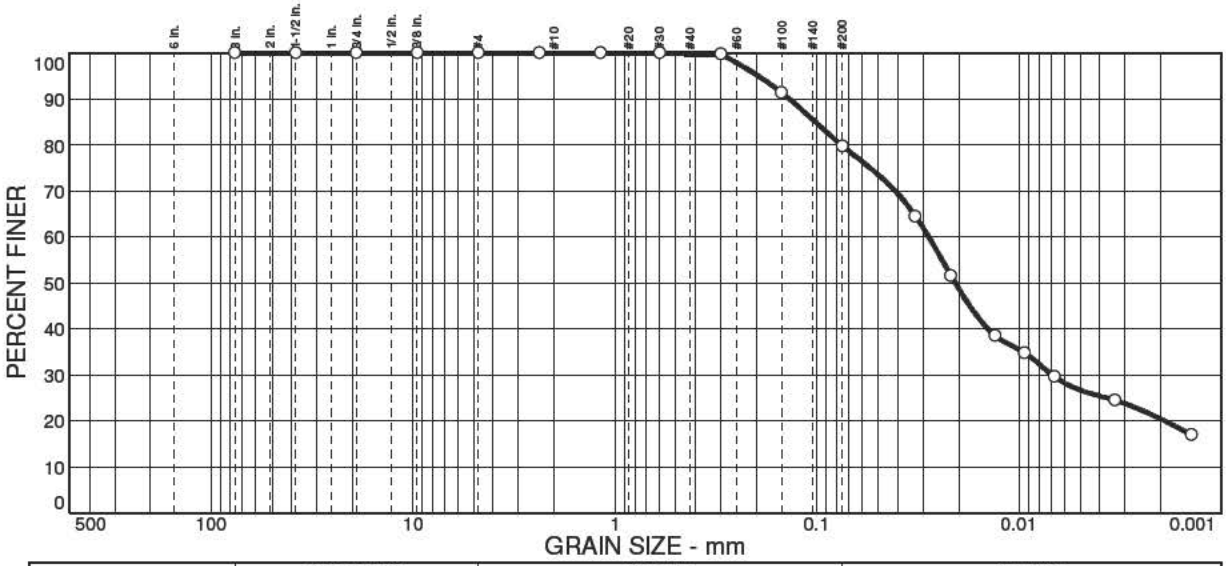
Particle Size Distribution Reports for Sediment/Soil Samples Collected in 2013 at the proposed Desoto Shallow Water Habitat Site

Midwest Laboratories, Inc.
13611 B Street • Omaha, Nebraska 68144-3693 • (402) 334-7770 • FAX (402) 334-9121 • www.midwestlabs.com

Particle Size Distribution Report

Project: DESOTO ELUTRIATE SPS-DESOTO-001 EDXDEJ051713 **Report No.:** 13-149-2024
Client: US ARMY CORPS OF ENGINEERS

Sample No: 2135679 **Source of Sample:** **Date:** 05/17/13
Location: DO-E1 **Elev./Depth:**



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	0.0	0.1	20.1	53.1	26.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3 in.	100.0		
1.5 in.	100.0		
.75 in.	100.0		
.375 in.	100.0		
#4	100.0		
#8	100.0		
#16	100.0		
#30	100.0		
#50	99.8		
#100	91.4		
#200	79.8		

* (no specification provided)

Soil Description

Atterberg Limits
PL= LL= PI=

Coefficients
D_{85}= 0.102 D_{60}= 0.0281 D_{50}= 0.0208
D_{30}= 0.0069 D_{15}= D_{10}=
C_u= C_c=

Classification
USCS= AASHTO=

Remarks

Figure

Midwest Laboratories, Inc.®
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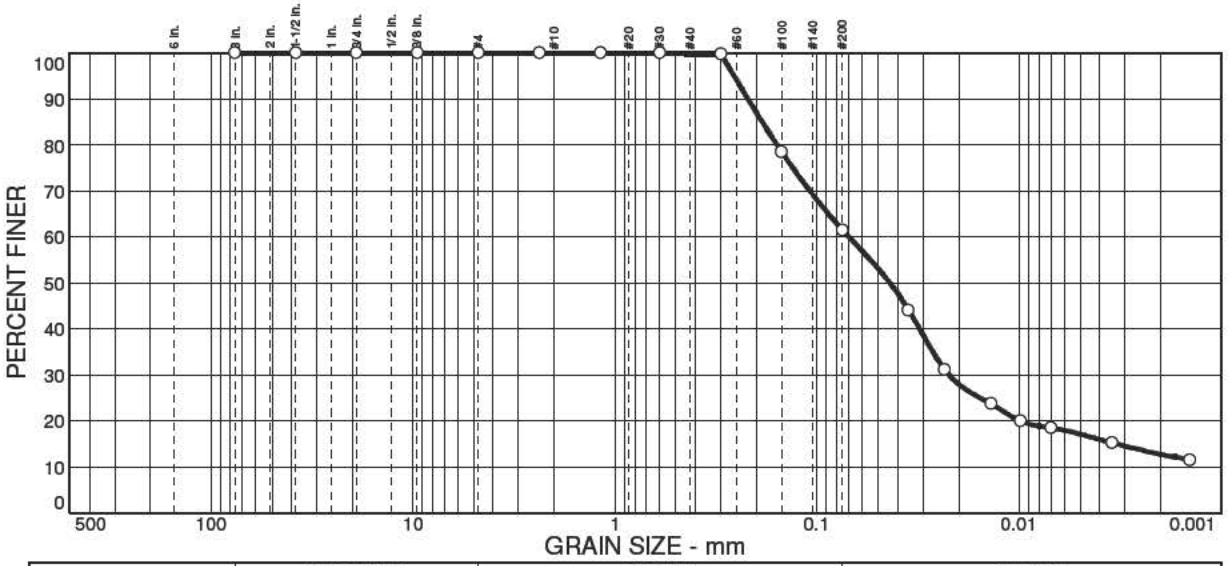
Particle Size Distribution Report

Project: DESOTO ELUTRIATE SPS-DESOTO-001 EDXDEJ051713 **Report No.:** 13-149-2025
Client: US ARMY CORPS OF ENGINEERS

Sample No: 2135680 **Source of Sample:** **Date:** 05/17/13
Location: DO-E2 **Elev./Depth:**



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	0.0	0.1	38.4	44.4	17.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3 in.	100.0		
1.5 in.	100.0		
.75 in.	100.0		
.375 in.	100.0		
#4	100.0		
#8	100.0		
#16	100.0		
#30	100.0		
#50	99.8		
#100	78.5		
#200	61.5		

* (no specification provided)

Soil Description

Atterberg Limits
PL= LL= PI=

Coefficients
D_{85}= 0.187 D_{60}= 0.0698 D_{50}= 0.0437
D_{30}= 0.0223 D_{15}= 0.0033 D_{10}=
C_u= C_c=

Classification
USCS= AASHTO=

Remarks

Figure

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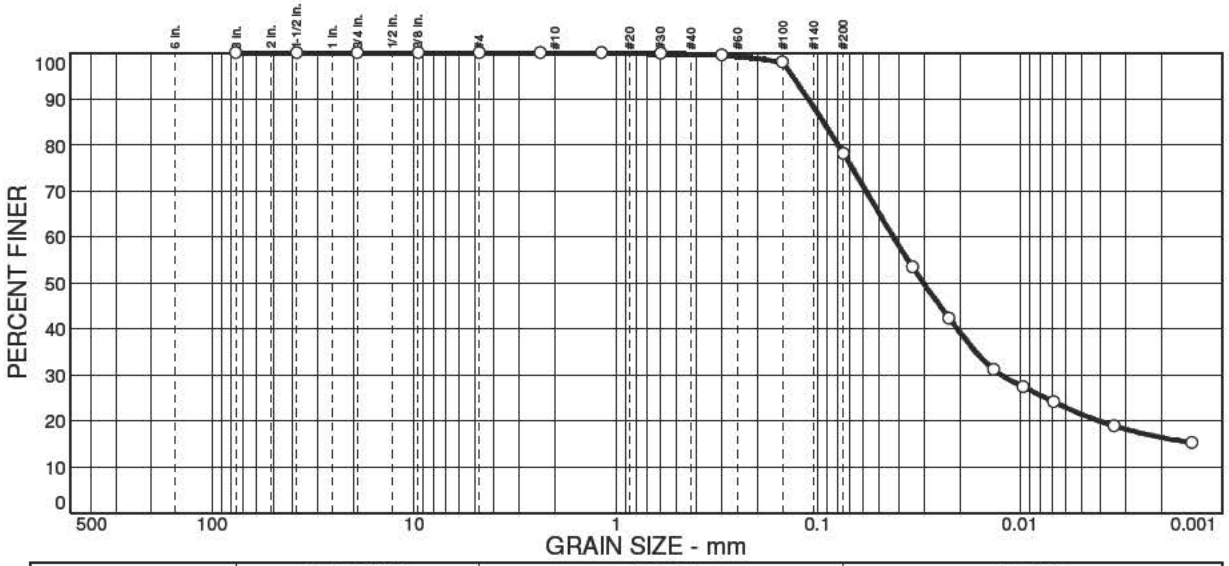
Particle Size Distribution Report

Project: DESOTO ELUTRIATE SPS-DESOTO-001 EDXDEJ051713 **Report No.:** 13-149-2026
Client: US ARMY CORPS OF ENGINEERS

Sample No: 2135681 **Source of Sample:** **Date:** 05/17/1
Location: DO-N1 **Elev./Depth:**



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	0.0	0.2	21.7	56.6	21.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3 in.	100.0		
1.5 in.	100.0		
.75 in.	100.0		
.375 in.	100.0		
#4	100.0		
#8	100.0		
#16	100.0		
#30	99.9		
#50	99.6		
#100	98.0		
#200	78.1		

* (no specification provided)

Soil Description

Atterberg Limits
PL= LL= PI=

Coefficients
D_{85}= 0.0943 D_{60}= 0.0425 D_{50}= 0.0302
D_{30}= 0.0124 D_{15}= D_{10}=
C_u= C_c=

Classification
USCS= AASHTO=

Remarks

Figure

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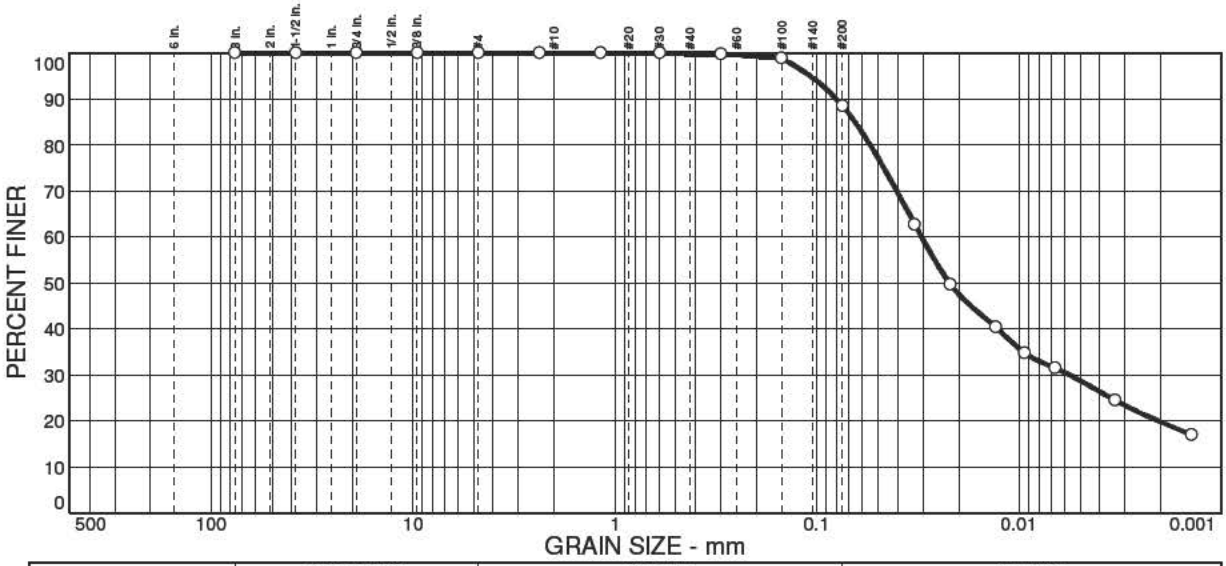
Particle Size Distribution Report

Project: DESOTO ELUTRIATE SPS-DESOTO-001 EDXDEJ051713 **Report No.:** 13-149-2027
Client: US ARMY CORPS OF ENGINEERS

Sample No: 2135682 **Source of Sample:** **Date:** 05/17/13
Location: DO-N2 **Elev./Depth:**



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	0.0	0.1	11.4	59.8	28.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3 in.	100.0		
1.5 in.	100.0		
.75 in.	100.0		
.375 in.	100.0		
#4	100.0		
#8	100.0		
#16	100.0		
#30	100.0		
#50	99.8		
#100	98.9		
#200	88.5		

* (no specification provided)

Soil Description

Atterberg Limits
PL= LL= PI=

Coefficients
D_{85}= 0.0651 D_{60}= 0.0305 D_{50}= 0.0222
D_{30}= 0.0057 D_{15}= D_{10}=
C_u= C_c=

Classification
USCS= AASHTO=

Remarks

Figure

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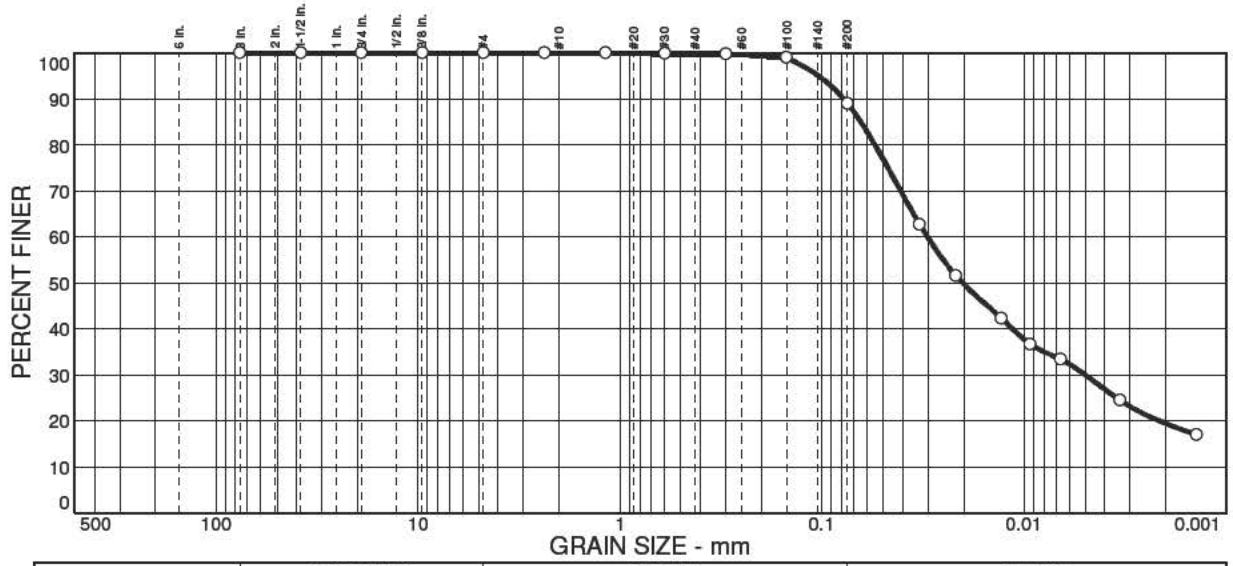
Particle Size Distribution Report

Project: DESOTO ELUTRIATE SPS-DESOTO-001 EDXDEJ051713 **Report No.:** 13-149-2027
Client: US ARMY CORPS OF ENGINEERS

Sample No: 2135682 DUP **Source of Sample:** **Date:** 05/17/13
Location: DO-N2 DUP **Elev./Depth:**



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	0.0	0.2	10.8	59.0	30.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3 in.	100.0		
1.5 in.	100.0		
.75 in.	100.0		
.375 in.	100.0		
#4	100.0		
#8	100.0		
#16	100.0		
#30	99.9		
#50	99.8		
#100	99.0		
#200	89.0		

* (no specification provided)

Soil Description

Atterberg Limits
PL= LL= PI=

Coefficients
D_{85}= 0.0645 D_{60}= 0.0301 D_{50}= 0.0202
D_{30}= 0.0050 D_{15}= D_{10}=
C_u= C_c=

Classification
USCS= AASHTO=

Remarks

Figure

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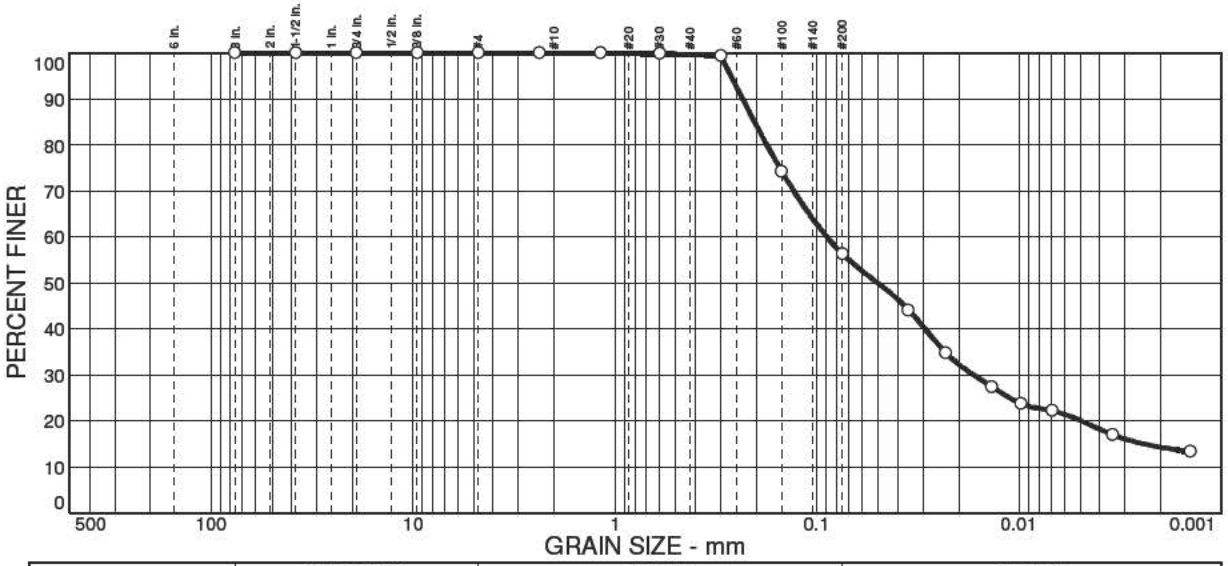
Particle Size Distribution Report

Project: DESOTO ELUTRIATE SPS-DESOTO-001 EDXDEJ051713 **Report No.:** 13-149-2028
Client: US ARMY CORPS OF ENGINEERS

Sample No: 2135683 **Source of Sample:** **Date:** 05/17/13
Location: DO-N3 **Elev./Depth:**



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
0.0	0.0	0.0	0.0	0.3	43.4	36.2	20.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3 in.	100.0		
1.5 in.	100.0		
.75 in.	100.0		
.375 in.	100.0		
#4	100.0		
#8	100.0		
#16	100.0		
#30	99.9		
#50	99.4		
#100	74.3		
#200	56.3		

* (no specification provided)

Soil Description

Atterberg Limits
PL= LL= PI=

Coefficients
D_{85}= 0.204 D_{60}= 0.0897 D_{50}= 0.0503
D_{30}= 0.0169 D_{15}= 0.0024 D_{10}=
C_u= C_c=

Classification
USCS= AASHTO=

Remarks

Figure

ATTACHMENT 3.

Laboratory Report of 2013 Results for Analysis of Collected Sediment/Soil, Receiving Water, and Prepared Pre-Elutriate and Elutriate Samples at the Proposed Wilson Island Shallow Water Habitat Site

Station	SampleSource	Analyte	Result	Units	Qual	Method	DF	MDL	MRL
DO-E1	FILTERED	Aluminum (Dissolved)	<30	ug/L	U	EPA 200.7	2	30	100
DO-E2	FILTERED	Aluminum (Dissolved)	<30	ug/L	U	EPA 200.7	2	30	100
DO	RECEIVING WATER	Aluminum (Dissolved)	140	ug/L		EPA 200.7	2	30	100
DO-E1	NON FILTERED	Aluminum (Total)	23380	ug/L		EPA 200.7	1	20	50
DO-E2	NON FILTERED	Aluminum (Total)	7920	ug/L		EPA 200.7	1	20	50
DO-E1	PRE ELUTRIATE	Aluminum (Total)	1344000	ug/L		EPA 200.7	5	80	250
DO-E2	PRE ELUTRIATE	Aluminum (Total)	1323000	ug/L		EPA 200.7	5	80	250
DO-N1	PRE ELUTRIATE	Aluminum (Total)	1413000	ug/L		EPA 200.7	5	80	250
DO-N2	PRE ELUTRIATE	Aluminum (Total)	1151000	ug/L		EPA 200.7	5	80	250
DO-N3	PRE ELUTRIATE	Aluminum (Total)	1159000	ug/L		EPA 200.7	5	80	250
DO	RECEIVING WATER	Aluminum (Total)	27900	ug/L		EPA 200.7	1	20	50
DO-E1	FILTERED	Ammonia as N	0.1	mg/L	J	SM 4500-NH3 G	1	0.02	0.1
DO-E2	FILTERED	Ammonia as N	0.3	mg/L		SM 4500-NH3 G	1	0.02	0.1
DO-E1	NON FILTERED	Ammonia as N	0.11	mg/L		SM 4500-NH3 G	1	0.02	0.1
DO-E2	NON FILTERED	Ammonia as N	0.29	mg/L		SM 4500-NH3 G	1	0.02	0.1
DO-E1	PRE ELUTRIATE	Ammonia as N	<0.02	mg/L		SM 4500-NH3 C-1997	1	0.02	0.1
DO-E2	PRE ELUTRIATE	Ammonia as N	<0.02	mg/L		SM 4500-NH3 C-1997	1	0.02	0.1
DO-N1	PRE ELUTRIATE	Ammonia as N	<0.02	mg/L		SM 4500-NH3 C-1997	1	0.02	0.1
DO-N2	PRE ELUTRIATE	Ammonia as N	<0.02	mg/L		SM 4500-NH3 C-1997	1	0.02	0.1
DO-N3	PRE ELUTRIATE	Ammonia as N	<0.02	mg/L		SM 4500-NH3 C-1997	1	0.02	0.1
DO	RECEIVING WATER	Ammonia as N	0.22	mg/L		SM 4500-NH3 G	1	0.02	0.1
DO-E1	SEDIMENT	Ammonia as N	0.7	mg/kg dry	J	SM 4500-NH3 G	5		1.3
DO-E2	SEDIMENT	Ammonia as N	2.7	mg/kg dry		SM 4500-NH3 G	5		1.4
DO-N1	SEDIMENT	Ammonia as N	0.6	mg/kg dry	J	SM 4500-NH3 G	5		1.3
DO-N2	SEDIMENT	Ammonia as N	0.9	mg/kg dry	J	SM 4500-NH3 G	5		1.3
DO-N3	SEDIMENT	Ammonia as N	0.7	mg/kg dry	J	SM 4500-NH3 G	5		1.2
DO-E1	FILTERED	Antimony (Dissolved)	<0.03	ug/L	U	EPA 200.8	1	0.03	0.5
DO-E2	FILTERED	Antimony (Dissolved)	0.2	ug/L	J	EPA 200.8	1	0.03	0.5
DO	RECEIVING WATER	Antimony (Dissolved)	0.05	ug/L	J	EPA 200.8	1	0.03	0.5
DO-E1	NON FILTERED	Antimony (Total)	0.7	ug/L		EPA 200.8	1	0.03	0.5
DO-E2	NON FILTERED	Antimony (Total)	0.9	ug/L		EPA 200.8	1	0.03	0.5
DO-E1	PRE ELUTRIATE	Antimony (Total)	3.3	ug/L		EPA 200.8	1	0.03	0.5
DO-E2	PRE ELUTRIATE	Antimony (Total)	2.9	ug/L		EPA 200.8	1	0.03	0.5
DO-N1	PRE ELUTRIATE	Antimony (Total)	3.8	ug/L		EPA 200.8	1	0.03	0.5
DO-N2	PRE ELUTRIATE	Antimony (Total)	4.1	ug/L		EPA 200.8	1	0.03	0.5
DO-N3	PRE ELUTRIATE	Antimony (Total)	3.9	ug/L		EPA 200.8	1	0.03	0.5
DO	RECEIVING WATER	Antimony (Total)	1	ug/L		EPA 200.8	1	0.03	0.5
DO-E1	FILTERED	Arsenic (Dissolved)	2	ug/L		EPA 200.8	1	0.2	1
DO-E2	FILTERED	Arsenic (Dissolved)	2	ug/L		EPA 200.8	1	0.2	1

Station	SampleSource	Analyte	Result	Units	Qual	Method	DF	MDL	MRL
DO	RECEIVING WATER	Arsenic (Dissolved)	3	ug/L		EPA 200.8	1	0.2	1
DO-E1	NON FILTERED	Arsenic (Total)	14	ug/L		EPA 200.8	1	0.2	1
DO-E2	NON FILTERED	Arsenic (Total)	5	ug/L		EPA 200.8	1	0.2	1
DO-E1	PRE ELUTRIATE	Arsenic (Total)	901	ug/L		EPA 200.8	1	0.2	1
DO-E2	PRE ELUTRIATE	Arsenic (Total)	791	ug/L		EPA 200.8	1	0.2	1
DO-N1	PRE ELUTRIATE	Arsenic (Total)	965	ug/L		EPA 200.8	1	0.2	1
DO-N2	PRE ELUTRIATE	Arsenic (Total)	1120	ug/L		EPA 200.8	1	0.2	1
DO-N3	PRE ELUTRIATE	Arsenic (Total)	779	ug/L		EPA 200.8	1	0.2	1
DO	RECEIVING WATER	Arsenic (Total)	20	ug/L		EPA 200.8	1	0.2	1
DO-E1	SEDIMENT	Arsenic (Total)	7.8	mg/kg dry		EPA 6020	100	0.01	0.6
DO-E2	SEDIMENT	Arsenic (Total)	7.7	mg/kg dry		EPA 6020	100	0.01	0.7
DO-E1	NON FILTERED	Atrazine	0.72	ug/L		NEP	1	0.08	0.5
DO-E2	NON FILTERED	Atrazine	0.87	ug/L		NEP	1	0.08	0.5
DO	RECEIVING WATER	Atrazine	1.35	ug/L		NEP	1	0.08	0.5
DO-E1	SEDIMENT	Atrazine	<0.002	ug/g	U	NEP	100	0.002	0.05
DO-E2	SEDIMENT	Atrazine	<0.002	ug/g	U	NEP	100	0.002	0.05
DO-E1	FILTERED	Beryllium (Dissolved)	1	ug/L	J	EPA 200.7	2	0.4	2
DO-E2	FILTERED	Beryllium (Dissolved)	1	ug/L	J	EPA 200.7	2	0.4	2
DO	RECEIVING WATER	Beryllium (Dissolved)	<0.4	ug/L	U	EPA 200.7	2	0.4	2
DO-E1	NON FILTERED	Beryllium (Total)	0.7	ug/L	J	EPA 200.7	1	0.2	1
DO-E2	NON FILTERED	Beryllium (Total)	0.2	ug/L	J	EPA 200.7	1	0.2	1
DO-E1	PRE ELUTRIATE	Beryllium (Total)	58	ug/L		EPA 200.7	5	1	5
DO-E2	PRE ELUTRIATE	Beryllium (Total)	60	ug/L		EPA 200.7	5	1	5
DO-N1	PRE ELUTRIATE	Beryllium (Total)	63	ug/L		EPA 200.7	5	1	5
DO-N2	PRE ELUTRIATE	Beryllium (Total)	53	ug/L		EPA 200.7	5	1	5
DO-N3	PRE ELUTRIATE	Beryllium (Total)	53	ug/L		EPA 200.7	5	1	5
DO	RECEIVING WATER	Beryllium (Total)	0.9	ug/L	J	EPA 200.7	1	0.2	1
DO-E1	FILTERED	Cadmium (Dissolved)	0.5	ug/L		EPA 200.8	1	0.01	0.5
DO-E2	FILTERED	Cadmium (Dissolved)	0.6	ug/L		EPA 200.8	1	0.01	0.5
DO	RECEIVING WATER	Cadmium (Dissolved)	1.1	ug/L		EPA 200.8	1	0.01	0.5
DO-E1	NON FILTERED	Cadmium (Total)	0.6	ug/L		EPA 200.8	1	0.01	0.5
DO-E2	NON FILTERED	Cadmium (Total)	0.2	ug/L		EPA 200.8	1	0.01	0.5
DO-E1	PRE ELUTRIATE	Cadmium (Total)	59.3	ug/L		EPA 200.8	1	0.01	0.5
DO-E2	PRE ELUTRIATE	Cadmium (Total)	58.2	ug/L		EPA 200.8	1	0.01	0.5
DO-N1	PRE ELUTRIATE	Cadmium (Total)	57.8	ug/L		EPA 200.8	1	0.01	0.5
DO-N2	PRE ELUTRIATE	Cadmium (Total)	52.5	ug/L		EPA 200.8	1	0.01	0.5
DO-N3	PRE ELUTRIATE	Cadmium (Total)	59.2	ug/L		EPA 200.8	1	0.01	0.5
DO	RECEIVING WATER	Cadmium (Total)	1.1	ug/L		EPA 200.8	1	0.01	0.5
DO-E1	SEDIMENT	Cadmium (Total)	0.7	mg/kg dry		EPA 6020	100	0.003	0.06

Station	SampleSource	Analyte	Result	Units	Qual	Method	DF	MDL	MRL
DO-E2	SEDIMENT	Cadmium (Total)	0.52	mg/kg dry		EPA 6020	100	0.003	0.07
DO-E1	FILTERED	Calcium (Dissolved)	95.75	mg/L		EPA 200.7	2	0.14	0.2
DO-E2	FILTERED	Calcium (Dissolved)	86.97	mg/L		EPA 200.7	2	0.14	0.2
DO	RECEIVING WATER	Calcium (Dissolved)	68.92	mg/L		EPA 200.7	2	0.14	0.2
DO-E1	NON FILTERED	Calcium (Total)	104.8	mg/L		EPA 200.7	1	0.07	0.1
DO-E2	NON FILTERED	Calcium (Total)	87.7	mg/L		EPA 200.7	1	0.07	0.1
DO-E1	PRE ELUTRIATE	Calcium (Total)	1329	mg/L		EPA 200.7	5	0.35	0.5
DO-E2	PRE ELUTRIATE	Calcium (Total)	2067	mg/L		EPA 200.7	5	0.35	0.5
DO-N1	PRE ELUTRIATE	Calcium (Total)	1405	mg/L		EPA 200.7	5	0.35	0.5
DO-N2	PRE ELUTRIATE	Calcium (Total)	1790	mg/L		EPA 200.7	5	0.35	0.5
DO-N3	PRE ELUTRIATE	Calcium (Total)	1239	mg/L		EPA 200.7	5	0.35	0.5
DO	RECEIVING WATER	Calcium (Total)	79.94	mg/L		EPA 200.7	1	0.07	0.1
DO-E1	NON FILTERED	Carbonaceous BOD	2	mg/L	J	SM 5210 B-2001	1	0.6	2
DO-E2	NON FILTERED	Carbonaceous BOD	0.9	mg/L	J	SM 5210 B-2001	1	0.6	2
DO-E1	PRE ELUTRIATE	Carbonaceous BOD	6	mg/L		SM 5210 B-2001	1	0.6	2
DO-E2	PRE ELUTRIATE	Carbonaceous BOD	7	mg/L		SM 5210 B-2001	1	0.6	2
DO-N1	PRE ELUTRIATE	Carbonaceous BOD	6	mg/L		SM 5210 B-2001	1	0.6	2
DO-N2	PRE ELUTRIATE	Carbonaceous BOD	5	mg/L		SM 5210 B-2001	1	0.6	2
DO-N3	PRE ELUTRIATE	Carbonaceous BOD	7	mg/L		SM 5210 B-2001	1	0.6	2
DO	RECEIVING WATER	Carbonaceous BOD	2	mg/L	J	SM 5210 B-2001	1	0.6	2
DO-E1	NON FILTERED	Chemical Oxygen Demand	23	mg/L		ASTM D1252-95-B	1	2	5
DO-E2	NON FILTERED	Chemical Oxygen Demand	7	mg/L		ASTM D1252-95-B	1	2	5
DO-E1	PRE ELUTRIATE	Chemical Oxygen Demand	2410	mg/L		ASTM D1252-95-B	20	38	100
DO-E2	PRE ELUTRIATE	Chemical Oxygen Demand	2100	mg/L		ASTM D1252-95-B	20	38	100
DO-N1	PRE ELUTRIATE	Chemical Oxygen Demand	2760	mg/L		ASTM D1252-95-B	20	38	100
DO-N2	PRE ELUTRIATE	Chemical Oxygen Demand	1760	mg/L		ASTM D1252-95-B	20	38	100
DO-N3	PRE ELUTRIATE	Chemical Oxygen Demand	3310	mg/L		ASTM D1252-95-B	40	75	200
DO	RECEIVING WATER	Chemical Oxygen Demand	74	mg/L		ASTM D1252-95-B	1	2	5
DO-E1	FILTERED	Chromium (Dissolved)	3	ug/L	J	EPA 200.7	2	2	20
DO-E2	FILTERED	Chromium (Dissolved)	5	ug/L	J	EPA 200.7	2	2	20
DO	RECEIVING WATER	Chromium (Dissolved)	<2	ug/L	U	EPA 200.7	2	2	20
DO-E1	NON FILTERED	Chromium (Total)	30	ug/L		EPA 200.7	1	1	10
DO-E2	NON FILTERED	Chromium (Total)	9	ug/L	J	EPA 200.7	1	1	10
DO-E1	PRE ELUTRIATE	Chromium (Total)	1690	ug/L		EPA 200.7	5	5	50
DO-E2	PRE ELUTRIATE	Chromium (Total)	1710	ug/L		EPA 200.7	5	5	50
DO-N1	PRE ELUTRIATE	Chromium (Total)	1840	ug/L		EPA 200.7	5	5	50
DO-N2	PRE ELUTRIATE	Chromium (Total)	1540	ug/L		EPA 200.7	5	5	50
DO-N3	PRE ELUTRIATE	Chromium (Total)	1560	ug/L		EPA 200.7	5	5	50
DO	RECEIVING WATER	Chromium (Total)	30	ug/L		EPA 200.7	1	1	10

Station	SampleSource	Analyte	Result	Units	Qual	Method	DF	MDL	MRL
DO-E1	SEDIMENT	Chromium (Total)	18.8	mg/kg dry		EPA 6010B	39.59	0.2	0.5
DO-E2	SEDIMENT	Chromium (Total)	17.8	mg/kg dry		EPA 6010B	41.98	0.2	0.6
DO-E1	FILTERED	Copper (Dissolved)	20	ug/L	J	EPA 200.7	2	4	20
DO-E2	FILTERED	Copper (Dissolved)	20	ug/L	J	EPA 200.7	2	4	20
DO	RECEIVING WATER	Copper (Dissolved)	10	ug/L	J	EPA 200.7	2	4	20
DO-E1	NON FILTERED	Copper (Total)	30	ug/L		EPA 200.7	1	2	10
DO-E2	NON FILTERED	Copper (Total)	10	ug/L		EPA 200.7	1	2	10
DO-E1	PRE ELUTRIATE	Copper (Total)	1760	ug/L		EPA 200.7	5	10	50
DO-E2	PRE ELUTRIATE	Copper (Total)	2020	ug/L		EPA 200.7	5	10	50
DO-N1	PRE ELUTRIATE	Copper (Total)	1970	ug/L		EPA 200.7	5	10	50
DO-N2	PRE ELUTRIATE	Copper (Total)	1820	ug/L		EPA 200.7	5	10	50
DO-N3	PRE ELUTRIATE	Copper (Total)	1710	ug/L		EPA 200.7	5	10	50
DO	RECEIVING WATER	Copper (Total)	40	ug/L		EPA 200.7	1	2	10
DO-E1	SEDIMENT	Copper (Total)	16.8	mg/kg dry		EPA 6010B	39.59	0.07	0.5
DO-E2	SEDIMENT	Copper (Total)	15.9	mg/kg dry		EPA 6010B	41.98	0.08	0.6
DO-E1	FILTERED	Iron (Dissolved)	20	ug/L	J	EPA 200.7	2	10	100
DO-E2	FILTERED	Iron (Dissolved)	20	ug/L	J	EPA 200.7	2	10	100
DO	RECEIVING WATER	Iron (Dissolved)	140	ug/L		EPA 200.7	2	10	100
DO-E1	NON FILTERED	Iron (Total)	25970	ug/L		EPA 200.7	1	5	50
DO-E2	NON FILTERED	Iron (Total)	7280	ug/L		EPA 200.7	1	5	50
DO-E1	PRE ELUTRIATE	Iron (Total)	2007000	ug/L		EPA 200.7	50	250	2500
DO-E2	PRE ELUTRIATE	Iron (Total)	2065000	ug/L		EPA 200.7	50	250	2500
DO-N1	PRE ELUTRIATE	Iron (Total)	2224000	ug/L		EPA 200.7	50	250	2500
DO-N2	PRE ELUTRIATE	Iron (Total)	1922000	ug/L		EPA 200.7	50	250	2500
DO-N3	PRE ELUTRIATE	Iron (Total)	1886000	ug/L		EPA 200.7	50	250	2500
DO	RECEIVING WATER	Iron (Total)	34680	ug/L		EPA 200.7	1	5	50
DO-E1	FILTERED	Lead (Dissolved)	<0.09	ug/L	U	EPA 200.8	1	0.09	0.5
DO-E2	FILTERED	Lead (Dissolved)	<0.09	ug/L	U	EPA 200.8	1	0.09	0.5
DO	RECEIVING WATER	Lead (Dissolved)	<0.09	ug/L	U	EPA 200.8	1	0.09	0.5
DO-E1	NON FILTERED	Lead (Total)	15.1	ug/L		EPA 200.8	1	0.09	0.5
DO-E2	NON FILTERED	Lead (Total)	5	ug/L		EPA 200.8	1	0.09	0.5
DO-E1	PRE ELUTRIATE	Lead (Total)	1136	ug/L		EPA 200.8	1	0.09	0.5
DO-E2	PRE ELUTRIATE	Lead (Total)	1187	ug/L		EPA 200.8	1	0.09	0.5
DO-N1	PRE ELUTRIATE	Lead (Total)	1170	ug/L		EPA 200.8	1	0.09	0.5
DO-N2	PRE ELUTRIATE	Lead (Total)	1123	ug/L		EPA 200.8	1	0.09	0.5
DO-N3	PRE ELUTRIATE	Lead (Total)	1053	ug/L		EPA 200.8	1	0.09	0.5
DO	RECEIVING WATER	Lead (Total)	23.7	ug/L		EPA 200.8	1	0.09	0.5
DO-E1	SEDIMENT	Lead (Total)	12.3	mg/kg dry		EPA 6010B	39.59	0.8	2.5
DO-E2	SEDIMENT	Lead (Total)	11.5	mg/kg dry		EPA 6010B	41.98	0.9	2.9

Station	SampleSource	Analyte	Result	Units	Qual	Method	DF	MDL	MRL
DO-E1	FILTERED	Magnesium (Dissolved)	22.34	mg/L		EPA 200.7	2	0.03	0.2
DO-E2	FILTERED	Magnesium (Dissolved)	18.14	mg/L		EPA 200.7	2	0.03	0.2
DO	RECEIVING WATER	Magnesium (Dissolved)	26.19	mg/L		EPA 200.7	2	0.03	0.2
DO-E1	NON FILTERED	Magnesium (Total)	28.78	mg/L		EPA 200.7	1	0.02	0.1
DO-E2	NON FILTERED	Magnesium (Total)	19.29	mg/L		EPA 200.7	1	0.02	0.1
DO-E1	PRE ELUTRIATE	Magnesium (Total)	684.9	mg/L		EPA 200.7	5	0.08	0.5
DO-E2	PRE ELUTRIATE	Magnesium (Total)	815.7	mg/L		EPA 200.7	5	0.08	0.5
DO-N1	PRE ELUTRIATE	Magnesium (Total)	705.1	mg/L		EPA 200.7	5	0.08	0.5
DO-N2	PRE ELUTRIATE	Magnesium (Total)	727.8	mg/L		EPA 200.7	5	0.08	0.5
DO-N3	PRE ELUTRIATE	Magnesium (Total)	565.4	mg/L		EPA 200.7	5	0.08	0.5
DO	RECEIVING WATER	Magnesium (Total)	34.33	mg/L		EPA 200.7	1	0.02	0.1
DO-E1	FILTERED	Manganese (Dissolved)	<4	ug/L	U	EPA 200.7	2	4	20
DO-E2	FILTERED	Manganese (Dissolved)	< 4	ug/L	U	EPA 200.7	2	4	20
DO	RECEIVING WATER	Manganese (Dissolved)	5	ug/L	J	EPA 200.7	2	4	20
DO-E1	NON FILTERED	Manganese (Total)	660	ug/L		EPA 200.7	1	2	10
DO-E2	NON FILTERED	Manganese (Total)	730	ug/L		EPA 200.7	1	2	10
DO-E1	PRE ELUTRIATE	Manganese (Total)	59090	ug/L		EPA 200.7	5	10	50
DO-E2	PRE ELUTRIATE	Manganese (Total)	57830	ug/L		EPA 200.7	5	10	50
DO-N1	PRE ELUTRIATE	Manganese (Total)	63300	ug/L		EPA 200.7	5	10	50
DO-N2	PRE ELUTRIATE	Manganese (Total)	60840	ug/L		EPA 200.7	5	10	50
DO-N3	PRE ELUTRIATE	Manganese (Total)	70150	ug/L		EPA 200.7	5	10	50
DO	RECEIVING WATER	Manganese (Total)	1400	ug/L		EPA 200.7	1	2	10
DO-E1	FILTERED	Mercury (Dissolved)	<0.008	ug/L	U	EPA 245.1	1	0.008	0.4
DO-E2	FILTERED	Mercury (Dissolved)	<0.008	ug/L	U	EPA 245.1	1	0.008	0.4
DO	RECEIVING WATER	Mercury (Dissolved)	<0.008	ug/L	U	EPA 245.1	1	0.008	0.4
DO-E1	NON FILTERED	Mercury (Total)	0.04	ug/L	J	EPA 245.1	1	0.008	0.4
DO-E2	NON FILTERED	Mercury (Total)	<0.008	ug/L	U	EPA 245.1	1	0.008	0.4
DO-E1	PRE ELUTRIATE	Mercury (Total)	3.4	ug/L		EPA 245.1	1	0.008	0.4
DO-E2	PRE ELUTRIATE	Mercury (Total)	3.1	ug/L		EPA 245.1	1	0.008	0.4
DO-N1	PRE ELUTRIATE	Mercury (Total)	3	ug/L		EPA 245.1	1	0.008	0.4
DO-N2	PRE ELUTRIATE	Mercury (Total)	3	ug/L		EPA 245.1	1	0.008	0.4
DO-N3	PRE ELUTRIATE	Mercury (Total)	3.3	ug/L		EPA 245.1	1	0.008	0.4
DO	RECEIVING WATER	Mercury (Total)	0.04	ug/L	J	EPA 245.1	1	0.008	0.4
DO-E1	SEDIMENT	Mercury (Total)	0.03	mg/kg dry	J	EPA 7471	200	0.002	0.06
DO-E2	SEDIMENT	Mercury (Total)	0.04	mg/kg dry	J	EPA 7471	200	0.002	0.07
DO-E1	FILTERED	Nickel (Dissolved)	10	ug/L	J	EPA 200.7	2	4	20
DO-E2	FILTERED	Nickel (Dissolved)	20	ug/L	J	EPA 200.7	2	4	20
DO	RECEIVING WATER	Nickel (Dissolved)	<4	ug/L	U	EPA 200.7	2	4	20
DO-E1	NON FILTERED	Nickel (Total)	30	ug/L		EPA 200.7	1	2	10

Station	SampleSource	Analyte	Result	Units	Qual	Method	DF	MDL	MRL
DO-E2	NON FILTERED	Nickel (Total)	10	ug/L		EPA 200.7	1	2	10
DO-E1	PRE ELUTRIATE	Nickel (Total)	2130	ug/L		EPA 200.7	5	10	50
DO-E2	PRE ELUTRIATE	Nickel (Total)	2370	ug/L		EPA 200.7	5	10	50
DO-N1	PRE ELUTRIATE	Nickel (Total)	2440	ug/L		EPA 200.7	5	10	50
DO-N2	PRE ELUTRIATE	Nickel (Total)	2160	ug/L		EPA 200.7	5	10	50
DO-N3	PRE ELUTRIATE	Nickel (Total)	2140	ug/L		EPA 200.7	5	10	50
DO	RECEIVING WATER	Nickel (Total)	40	ug/L		EPA 200.7	1	2	10
DO-E1	SEDIMENT	Nickel (Total)	21.2	mg/kg dry		EPA 6010B	39.59	0.2	0.5
DO-E2	SEDIMENT	Nickel (Total)	20.8	mg/kg dry		EPA 6010B	41.98	0.2	0.6
DO-E1	FILTERED	Nitrate/Nitrite Nitrogen	4.48	mg/L		EPA 353.2	1	0.02	0.2
DO-E2	FILTERED	Nitrate/Nitrite Nitrogen	1.15	mg/L		EPA 353.2	1	0.02	0.2
DO-E1	PRE ELUTRIATE	Nitrate/Nitrite Nitrogen	4.8	mg/L		EPA 353.2	1	0.02	0.2
DO-E2	PRE ELUTRIATE	Nitrate/Nitrite Nitrogen	1.24	mg/L		EPA 353.2	1	0.02	0.2
DO-N1	PRE ELUTRIATE	Nitrate/Nitrite Nitrogen	6.16	mg/L		EPA 353.2	1	0.02	0.2
DO-N2	PRE ELUTRIATE	Nitrate/Nitrite Nitrogen	2.47	mg/L		EPA 353.2	1	0.02	0.2
DO-N3	PRE ELUTRIATE	Nitrate/Nitrite Nitrogen	10.8	mg/L		EPA 353.2	1	0.02	0.2
DO	RECEIVING WATER	Nitrate/Nitrite Nitrogen	1.3	mg/L		EPA 353.2	1	0.02	0.2
DO-E1	SEDIMENT	Nitrate/Nitrite Nitrogen	9.8	mg/kg dry		EPA 353.2	5	0.04	1.3
DO-E2	SEDIMENT	Nitrate/Nitrite Nitrogen	0.2	mg/kg dry	J	EPA 353.2	5	0.05	1.4
DO-N1	SEDIMENT	Nitrate/Nitrite Nitrogen	16.1	mg/kg dry		EPA 353.2	5	0.05	1.3
DO-N2	SEDIMENT	Nitrate/Nitrite Nitrogen	4.2	mg/kg dry		EPA 353.2	5	0.05	1.3
DO-N3	SEDIMENT	Nitrate/Nitrite Nitrogen	28.7	mg/kg dry		EPA 353.2	5	0.04	1.2
DO-E1	FILTERED	Orthophosphate (Dissolved)	0.53	mg/L		SM 4500-P G-1999	1	0.005	0.05
DO-E2	FILTERED	Orthophosphate (Dissolved)	0.1	mg/L		SM 4500-P G-1999	1	0.005	0.05
DO	RECEIVING WATER	Orthophosphate (Dissolved)	0.08	mg/L		SM 4500-P G-1999	1	0.005	0.05
DO-E1	SEDIMENT	Percent Solids	78.05	%		SM 2540 G	1	0.01	0.01
DO-E2	SEDIMENT	Percent Solids	72.25	%		SM 2540 G	1	0.01	0.01
DO-N1	SEDIMENT	Percent Solids	77.1	%		SM 2540 G	1	0.01	0.01
DO-N2	SEDIMENT	Percent Solids	76.99	%		SM 2540 G	1	0.01	0.01
DO-N3	SEDIMENT	Percent Solids	81.26	%		SM 2540 G	1	0.01	0.01
DO-E1	NON FILTERED	pH	7.7	S.U.		SM 4500-H B-2000	1		
DO-E2	NON FILTERED	pH	7.79	S.U.		SM 4500-H B-2000	1		
DO-E1	PRE ELUTRIATE	pH	7.53	S.U.		SM 4500-H B-2000	1		
DO-E2	PRE ELUTRIATE	pH	7.62	S.U.		SM 4500-H B-2000	1		
DO-N1	PRE ELUTRIATE	pH	7.62	S.U.		SM 4500-H B-2000	1		
DO-N2	PRE ELUTRIATE	pH	7.69	S.U.		SM 4500-H B-2000	1		
DO-N3	PRE ELUTRIATE	pH	7.56	S.U.		SM 4500-H B-2000	1		
DO	RECEIVING WATER	pH	8.22	S.U.		SM 4500-H B-2000	1		
DO-E1	SEDIMENT	pH	7.53	S.U.		EPA 9045	1		

Station	SampleSource	Analyte	Result	Units	Qual	Method	DF	MDL	MRL
DO-E2	SEDIMENT	pH	7.37	S.U.		EPA 9045	1		
DO-N1	SEDIMENT	pH	7.39	S.U.		EPA 9045	1		
DO-N2	SEDIMENT	pH	7.52	S.U.		EPA 9045	1		
DO-N3	SEDIMENT	pH	7.25	S.U.		EPA 9045	1		
DO-E1	FILTERED	Phosphorus (Total Dissolved)	0.44	mg/L		SM 4500-P F	1	0.008	0.05
DO-E2	FILTERED	Phosphorus (Total Dissolved)	0.07	mg/L		SM 4500-P F	1	0.008	0.05
DO	RECEIVING WATER	Phosphorus (Total Dissolved)	0.05	mg/L	J	SM 4500-P F	1	0.008	0.05
DO-E1	NON FILTERED	Phosphorus (Total)	0.74	mg/L		SM 4500-P F	2	0.02	0.1
DO-E2	NON FILTERED	Phosphorus (Total)	0.17	mg/L		SM 4500-P F	1	0.008	0.05
DO-E1	PRE ELUTRIATE	Phosphorus (Total)	69.4	mg/L		SM 4500-P F	20	0.16	1
DO-E2	PRE ELUTRIATE	Phosphorus (Total)	74.7	mg/L		SM 4500-P F	20	0.16	1
DO-N1	PRE ELUTRIATE	Phosphorus (Total)	75.8	mg/L		SM 4500-P F	50	0.4	2.5
DO-N2	PRE ELUTRIATE	Phosphorus (Total)	76.3	mg/L		SM 4500-P F	50	0.4	2.5
DO-N3	PRE ELUTRIATE	Phosphorus (Total)	64.6	mg/L		SM 4500-P F	50	0.4	2.5
DO	RECEIVING WATER	Phosphorus (Total)	1.01	mg/L		SM 4500-P F	1	0.008	0.05
DO-E1	SEDIMENT	Phosphorus (Total)	792	mg/kg dry		EPA 6010B	39.59	0.9	5.1
DO-E2	SEDIMENT	Phosphorus (Total)	650	mg/kg dry		EPA 6010B	41.98	1	5.8
DO-N1	SEDIMENT	Phosphorus (Total)	838.9	mg/kg dry		EPA 6010B	46.75	1	6.1
DO-N2	SEDIMENT	Phosphorus (Total)	774.6	mg/kg dry		EPA 6010B	55.77	1.2	7.2
DO-N3	SEDIMENT	Phosphorus (Total)	748.5	mg/kg dry		EPA 6010B	54.02	1.1	6.6
DO-E1	FILTERED	Selenium (Dissolved)	5	ug/L		EPA 200.8	1	0.4	1
DO-E2	FILTERED	Selenium (Dissolved)	1	ug/L		EPA 200.8	1	0.4	1
DO	RECEIVING WATER	Selenium (Dissolved)	0.8	ug/L	J	EPA 200.8	1	0.4	1
DO-E1	NON FILTERED	Selenium (Total)	6	ug/L		EPA 200.8	1	0.4	1
DO-E2	NON FILTERED	Selenium (Total)	3	ug/L		EPA 200.8	1	0.4	1
DO-E1	PRE ELUTRIATE	Selenium (Total)	82	ug/L		EPA 200.8	1	0.4	1
DO-E2	PRE ELUTRIATE	Selenium (Total)	96	ug/L		EPA 200.8	1	0.4	1
DO-N1	PRE ELUTRIATE	Selenium (Total)	89	ug/L		EPA 200.8	1	0.4	1
DO-N2	PRE ELUTRIATE	Selenium (Total)	69	ug/L		EPA 200.8	1	0.4	1
DO-N3	PRE ELUTRIATE	Selenium (Total)	84	ug/L		EPA 200.8	1	0.4	1
DO	RECEIVING WATER	Selenium (Total)	4	ug/L		EPA 200.8	1	0.4	1
DO-E1	FILTERED	Silver (Dissolved)	<4	ug/L	U	EPA 200.7	2	4	20
DO-E2	FILTERED	Silver (Dissolved)	<4	ug/L	U	EPA 200.7	2	4	20
DO	RECEIVING WATER	Silver (Dissolved)	<4	ug/L	U	EPA 200.7	2	4	20
DO-E1	NON FILTERED	Silver (Total)	<2	ug/L	U	EPA 200.7	1	2	10
DO-E2	NON FILTERED	Silver (Total)	<2	ug/L	U	EPA 200.7	1	2	10
DO-E1	PRE ELUTRIATE	Silver (Total)	<10	ug/L	U	EPA 200.7	5	10	50
DO-E2	PRE ELUTRIATE	Silver (Total)	<10	ug/L	U	EPA 200.7	5	10	50
DO-N1	PRE ELUTRIATE	Silver (Total)	<10	ug/L	U	EPA 200.7	5	10	50

Station	SampleSource	Analyte	Result	Units	Qual	Method	DF	MDL	MRL
DO-N2	PRE ELUTRIATE	Silver (Total)	<10	ug/L	U	EPA 200.7	5	10	50
DO-N3	PRE ELUTRIATE	Silver (Total)	<10	ug/L	U	EPA 200.7	5	10	50
DO	RECEIVING WATER	Silver (Total)	<2	ug/L	U	EPA 200.7	1	2	10
DO-E1	FILTERED	Thallium (Dissolved)	<0.005	ug/L		EPA 200.8	1	0.005	0.5
DO-E2	FILTERED	Thallium (Dissolved)	<0.005	ug/L		EPA 200.8	1	0.005	0.5
DO	RECEIVING WATER	Thallium (Dissolved)	<0.005	ug/L		EPA 200.8	1	0.005	0.5
DO-E1	NON FILTERED	Thallium (Total)	0.3	ug/L	J	EPA 200.8	1	0.005	0.5
DO-E2	NON FILTERED	Thallium (Total)	0.09	ug/L	J	EPA 200.8	1	0.005	0.5
DO-E1	PRE ELUTRIATE	Thallium (Total)	26.8	ug/L		EPA 200.8	1	0.005	0.5
DO-E2	PRE ELUTRIATE	Thallium (Total)	25.9	ug/L		EPA 200.8	1	0.005	0.5
DO-N1	PRE ELUTRIATE	Thallium (Total)	26.1	ug/L		EPA 200.8	1	0.005	0.5
DO-N2	PRE ELUTRIATE	Thallium (Total)	24.2	ug/L		EPA 200.8	1	0.005	0.5
DO-N3	PRE ELUTRIATE	Thallium (Total)	23.4	ug/L		EPA 200.8	1	0.005	0.5
DO	RECEIVING WATER	Thallium (Total)	0.5	ug/L		EPA 200.8	1	0.005	0.5
DO-E1	NON FILTERED	Total Kjeldahl Nitrogen	2.16	mg/L		PAI-DK 02	1	0.08	0.5
DO-E2	NON FILTERED	Total Kjeldahl Nitrogen	0.99	mg/L		PAI-DK 02	1	0.08	0.5
DO-E1	PRE ELUTRIATE	Total Kjeldahl Nitrogen	109	mg/L		PAI-DK 01	1	0.07	0.5
DO-E2	PRE ELUTRIATE	Total Kjeldahl Nitrogen	88.4	mg/L		PAI-DK 01	1	0.07	0.5
DO-N1	PRE ELUTRIATE	Total Kjeldahl Nitrogen	122	mg/L		PAI-DK 01	1	0.07	0.5
DO-N2	PRE ELUTRIATE	Total Kjeldahl Nitrogen	86.5	mg/L		PAI-DK 01	1	0.07	0.5
DO-N3	PRE ELUTRIATE	Total Kjeldahl Nitrogen	157	mg/L		PAI-DK 01	1	0.07	0.5
DO	RECEIVING WATER	Total Kjeldahl Nitrogen	2.16	mg/L		PAI-DK 02	1	0.08	0.5
DO-E1	SEDIMENT	Total Kjeldahl Nitrogen	921	mg/kg dry		PAI-DK 01	20	7	12.8
DO-E2	SEDIMENT	Total Kjeldahl Nitrogen	579	mg/kg dry		PAI-DK 01	20	7.6	13.8
DO-N1	SEDIMENT	Total Kjeldahl Nitrogen	1080	mg/kg dry		PAI-DK 01	20	7.1	13
DO-N2	SEDIMENT	Total Kjeldahl Nitrogen	942	mg/kg dry		PAI-DK 01	20	7.1	13
DO-N3	SEDIMENT	Total Kjeldahl Nitrogen	802	mg/kg dry		PAI-DK 01	20	6.7	12.3
DO-E1	NON FILTERED	Total Organic Carbon	11	mg/L		SM 5310 B-2000	1	0.3	1
DO-E2	NON FILTERED	Total Organic Carbon	3.1	mg/L		SM 5310 B-2000	1	0.3	1
DO-E1	PRE ELUTRIATE	Total Organic Carbon	1530	mg/L		SM 5310 B-2000	1	0.3	1
DO-E2	PRE ELUTRIATE	Total Organic Carbon	1120	mg/L		SM 5310 B-2000	1	0.3	1
DO-N1	PRE ELUTRIATE	Total Organic Carbon	1380	mg/L		SM 5310 B-2000	1	0.3	1
DO-N2	PRE ELUTRIATE	Total Organic Carbon	1080	mg/L		SM 5310 B-2000	1	0.3	1
DO-N3	PRE ELUTRIATE	Total Organic Carbon	1960	mg/L		SM 5310 B-2000	1	0.3	1
DO	RECEIVING WATER	Total Organic Carbon	17.9	mg/L		SM 5310 B-2000	1	0.3	1
DO-E1	SEDIMENT	Total Organic Carbon	2.13	% dry		ASTM D5373-08(mod)	1	0.01	0.01
DO-E2	SEDIMENT	Total Organic Carbon	0.86	% dry		ASTM D5373-08(mod)	1	0.01	0.01
DO-N1	SEDIMENT	Total Organic Carbon	1.23	% dry		ASTM D5373-08(mod)	1	0.01	0.01
DO-N2	SEDIMENT	Total Organic Carbon	1.58	% dry		ASTM D5373-08(mod)	1	0.01	0.01

Station	SampleSource	Analyte	Result	Units	Qual	Method	DF	MDL	MRL
DO-N3	SEDIMENT	Total Organic Carbon	1.5	% dry		ASTM D5373-08(mod)	1	0.01	0.01
DO-E1	NON FILTERED	Total Suspended Solids	752	mg/L		SM 2540 D-1997	1	4	4
DO-E2	NON FILTERED	Total Suspended Solids	173	mg/L		SM 2540 D-1997	1	4	4
DO-E1	PRE ELUTRIATE	Total Suspended Solids	135000	mg/L		SM 2540 D-1997	1	4	4
DO-E2	PRE ELUTRIATE	Total Suspended Solids	153000	mg/L		SM 2540 D-1997	1	4	4
DO-N1	PRE ELUTRIATE	Total Suspended Solids	130000	mg/L		SM 2540 D-1997	1	4	4
DO-N2	PRE ELUTRIATE	Total Suspended Solids	116000	mg/L		SM 2540 D-1997	1	4	4
DO-N3	PRE ELUTRIATE	Total Suspended Solids	103000	mg/L		SM 2540 D-1997	1	4	4
DO	RECEIVING WATER	Total Suspended Solids	1040	mg/L		SM 2540 D-1997	1	4	4
DO-E1	NON FILTERED	Turbidity	590	NTU		EPA 180.1	5000	50	50
DO-E2	NON FILTERED	Turbidity	151	NTU		EPA 180.1	1000	10	10
DO-E1	PRE ELUTRIATE	Turbidity	39600	NTU		EPA 180.1	100000	1000	1000
DO-E2	PRE ELUTRIATE	Turbidity	35800	NTU		EPA 180.1	100000	1000	1000
DO-N1	PRE ELUTRIATE	Turbidity	40100	NTU		EPA 180.1	500000	5000	5000
DO-N2	PRE ELUTRIATE	Turbidity	32300	NTU		EPA 180.1	100000	1000	1000
DO-N3	PRE ELUTRIATE	Turbidity	36500	NTU		EPA 180.1	100000	1000	1000
DO	RECEIVING WATER	Turbidity	730	NTU		EPA 180.1	5000	50	50
DO-E1	FILTERED	Zinc (Dissolved)	8	ug/L	J	EPA 200.7	2	4	20
DO-E2	FILTERED	Zinc (Dissolved)	10	ug/L	J	EPA 200.7	2	4	20
DO	RECEIVING WATER	Zinc (Dissolved)	<4	ug/L	U	EPA 200.7	2	4	20
DO-E1	NON FILTERED	Zinc (Total)	110	ug/L		EPA 200.7	1	2	10
DO-E2	NON FILTERED	Zinc (Total)	50	ug/L		EPA 200.7	1	2	10
DO-E1	PRE ELUTRIATE	Zinc (Total)	6420	ug/L		EPA 200.7	5	10	50
DO-E2	PRE ELUTRIATE	Zinc (Total)	6860	ug/L		EPA 200.7	5	10	50
DO-N1	PRE ELUTRIATE	Zinc (Total)	6950	ug/L		EPA 200.7	5	10	50
DO-N2	PRE ELUTRIATE	Zinc (Total)	5970	ug/L		EPA 200.7	5	10	50
DO-N3	PRE ELUTRIATE	Zinc (Total)	6260	ug/L		EPA 200.7	5	10	50
DO	RECEIVING WATER	Zinc (Total)	120	ug/L		EPA 200.7	1	2	10
DO-E1	SEDIMENT	Zinc (Total)	65.2	mg/kg dry		EPA 6010B	39.59	0.2	0.5
DO-E2	SEDIMENT	Zinc (Total)	59.8	mg/kg dry		EPA 6010B	41.98	0.2	0.6
DO-E1	NON FILTERED	4,4'-DDD	<0.004	ug/L	U	EPA 8081	5	0.004	0.1
DO-E2	NON FILTERED	4,4'-DDD	<0.004	ug/L	U	EPA 8081	5	0.004	0.1
DO	RECEIVING WATER	4,4'-DDD	<0.004	ug/L	U	EPA 8081	5	0.004	0.1
DO-E1	SEDIMENT	4,4'-DDD	<1	ug/kg	U	EPA 8081	500	1	10
DO-E2	SEDIMENT	4,4'-DDD	<1	ug/kg	U	EPA 8081	500	1	10
DO-E1	NON FILTERED	4,4'-DDE	<0.004	ug/L	U	EPA 8081	5	0.004	0.1
DO-E2	NON FILTERED	4,4'-DDE	<0.004	ug/L	U	EPA 8081	5	0.004	0.1
DO	RECEIVING WATER	4,4'-DDE	<0.004	ug/L	U	EPA 8081	5	0.004	0.1
DO-E1	SEDIMENT	4,4'-DDE	<1	ug/kg	U	EPA 8081	500	1	10

Station	SampleSource	Analyte	Result	Units	Qual	Method	DF	MDL	MRL
DO-E2	SEDIMENT	4,4'-DDE	<1	ug/kg	U	EPA 8081	500	1	10
DO-E1	NON FILTERED	4,4'-DDT	<0.003	ug/L	U	EPA 8081	5	0.003	0.1
DO-E2	NON FILTERED	4,4'-DDT	<0.003	ug/L	U	EPA 8081	5	0.003	0.1
DO	RECEIVING WATER	4,4'-DDT	<0.003	ug/L	U	EPA 8081	5	0.003	0.1
DO-E1	SEDIMENT	4,4'-DDT	<3	ug/kg	U	EPA 8081	500	3	10
DO-E2	SEDIMENT	4,4'-DDT	<3	ug/kg	U	EPA 8081	500	3	10
DO-E1	NON FILTERED	Aldrin	<0.006	ug/L	U	EPA 8081	5	0.006	0.5
DO-E2	NON FILTERED	Aldrin	<0.006	ug/L	U	EPA 8081	5	0.006	0.5
DO	RECEIVING WATER	Aldrin	<0.006	ug/L	U	EPA 8081	5	0.006	0.5
DO-E1	SEDIMENT	Aldrin	<1	ug/kg	U	EPA 8081	500	1	5
DO-E2	SEDIMENT	Aldrin	<1	ug/kg	U	EPA 8081	500	1	5
DO-E1	NON FILTERED	alpha-BHC	<0.004	ug/L	U	EPA 8081	5	0.004	0.05
DO-E2	NON FILTERED	alpha-BHC	<0.004	ug/L	U	EPA 8081	5	0.004	0.05
DO	RECEIVING WATER	alpha-BHC	<0.004	ug/L	U	EPA 8081	5	0.004	0.05
DO-E1	SEDIMENT	alpha-BHC	<1	ug/kg	U	EPA 8081	500	1	5
DO-E2	SEDIMENT	alpha-BHC	<1	ug/kg	U	EPA 8081	500	1	5
DO-E1	NON FILTERED	alpha-Chlordane	<0.004	ug/L	U	EPA 8081	5	0.004	0.05
DO-E2	NON FILTERED	alpha-Chlordane	<0.004	ug/L	U	EPA 8081	5	0.004	0.05
DO	RECEIVING WATER	alpha-Chlordane	<0.004	ug/L	U	EPA 8081	5	0.004	0.05
DO-E1	SEDIMENT	alpha-Chlordane	<1	ug/kg	U	EPA 8081	500	1	5
DO-E2	SEDIMENT	alpha-Chlordane	<1	ug/kg	U	EPA 8081	500	1	5
DO-E1	NON FILTERED	beta-BHC	<0.003	ug/L	U	EPA 8081	5	0.003	0.05
DO-E2	NON FILTERED	beta-BHC	<0.003	ug/L	U	EPA 8081	5	0.003	0.05
DO	RECEIVING WATER	beta-BHC	<0.003	ug/L	U	EPA 8081	5	0.003	0.05
DO-E1	SEDIMENT	beta-BHC	<5	ug/kg	U	EPA 8081	500	5	5
DO-E2	SEDIMENT	beta-BHC	<5	ug/kg	U	EPA 8081	500	5	5
DO-E1	NON FILTERED	delta-BHC	<0.02	ug/L	U	EPA 8081	5	0.02	0.05
DO-E2	NON FILTERED	delta-BHC	<0.02	ug/L	U	EPA 8081	5	0.02	0.05
DO	RECEIVING WATER	delta-BHC	<0.02	ug/L	U	EPA 8081	5	0.02	0.05
DO-E1	SEDIMENT	delta-BHC	<1	ug/kg	U	EPA 8081	500	1	5
DO-E2	SEDIMENT	delta-BHC	<1	ug/kg	U	EPA 8081	500	1	5
DO-E1	NON FILTERED	Dieldrin	<0.004	ug/L	U	EPA 8081	5	0.004	0.1
DO-E2	NON FILTERED	Dieldrin	<0.004	ug/L	U	EPA 8081	5	0.004	0.1
DO	RECEIVING WATER	Dieldrin	<0.004	ug/L	U	EPA 8081	5	0.004	0.1
DO-E1	SEDIMENT	Dieldrin	<1	ug/kg	U	EPA 8081	500	1	10
DO-E2	SEDIMENT	Dieldrin	<1	ug/kg	U	EPA 8081	500	1	10
DO-E1	NON FILTERED	Endosulfan I	<0.004	ug/L	U	EPA 8081	5	0.004	0.05
DO-E2	NON FILTERED	Endosulfan I	<0.004	ug/L	U	EPA 8081	5	0.004	0.05
DO	RECEIVING WATER	Endosulfan I	<0.004	ug/L	U	EPA 8081	5	0.004	0.05

Station	SampleSource	Analyte	Result	Units	Qual	Method	DF	MDL	MRL
DO-E1	SEDIMENT	Endosulfan I	<1	ug/kg	U	EPA 8081	500	1	5
DO-E2	SEDIMENT	Endosulfan I	<1	ug/kg	U	EPA 8081	500	1	5
DO-E1	NON FILTERED	Endosulfan II	<0.003	ug/L	U	EPA 8081	5	0.003	0.1
DO-E2	NON FILTERED	Endosulfan II	<0.003	ug/L	U	EPA 8081	5	0.003	0.1
DO	RECEIVING WATER	Endosulfan II	<0.003	ug/L	U	EPA 8081	5	0.003	0.1
DO-E1	SEDIMENT	Endosulfan II	<1	ug/kg	U	EPA 8081	500	1	10
DO-E2	SEDIMENT	Endosulfan II	<1	ug/kg	U	EPA 8081	500	1	10
DO-E1	NON FILTERED	Endosulfan sulfate	<0.004	ug/L	U	EPA 8081	5	0.004	0.1
DO-E2	NON FILTERED	Endosulfan sulfate	<0.004	ug/L	U	EPA 8081	5	0.004	0.1
DO	RECEIVING WATER	Endosulfan sulfate	<0.004	ug/L	U	EPA 8081	5	0.004	0.1
DO-E1	SEDIMENT	Endosulfan sulfate	<1	ug/kg	U	EPA 8081	500	1	10
DO-E2	SEDIMENT	Endosulfan sulfate	<1	ug/kg	U	EPA 8081	500	1	10
DO-E1	NON FILTERED	Endrin	<0.004	ug/L	U	EPA 8081	5	0.004	0.1
DO-E2	NON FILTERED	Endrin	<0.004	ug/L	U	EPA 8081	5	0.004	0.1
DO	RECEIVING WATER	Endrin	<0.004	ug/L	U	EPA 8081	5	0.004	0.1
DO-E1	SEDIMENT	Endrin	<2	ug/kg	U	EPA 8081	500	2	10
DO-E2	SEDIMENT	Endrin	<2	ug/kg	U	EPA 8081	500	2	10
DO-E1	NON FILTERED	Endrin aldehyde	<0.004	ug/L	U	EPA 8081	5	0.004	0.1
DO-E2	NON FILTERED	Endrin aldehyde	<0.004	ug/L	U	EPA 8081	5	0.004	0.1
DO	RECEIVING WATER	Endrin aldehyde	<0.004	ug/L	U	EPA 8081	5	0.004	0.1
DO-E1	SEDIMENT	Endrin aldehyde	<3	ug/kg	U	EPA 8081	500	3	10
DO-E2	SEDIMENT	Endrin aldehyde	<3	ug/kg	U	EPA 8081	500	3	10
DO-E1	NON FILTERED	Endrin ketone	<0.003	ug/L	U	EPA 8081	5	0.003	0.1
DO-E2	NON FILTERED	Endrin ketone	<0.003	ug/L	U	EPA 8081	5	0.003	0.1
DO	RECEIVING WATER	Endrin ketone	<0.003	ug/L	U	EPA 8081	5	0.003	0.1
DO-E1	SEDIMENT	Endrin ketone	<1	ug/kg	U	EPA 8081	500	1	10
DO-E2	SEDIMENT	Endrin ketone	<1	ug/kg	U	EPA 8081	500	1	10
DO-E1	NON FILTERED	gamma-BHC (Lindane)	<0.004	ug/L	U	EPA 8081	5	0.004	0.05
DO-E2	NON FILTERED	gamma-BHC (Lindane)	<0.004	ug/L	U	EPA 8081	5	0.004	0.05
DO	RECEIVING WATER	gamma-BHC (Lindane)	<0.004	ug/L	U	EPA 8081	5	0.004	0.05
DO-E1	SEDIMENT	gamma-BHC (Lindane)	<2	ug/kg	U	EPA 8081	500	2	5
DO-E2	SEDIMENT	gamma-BHC (Lindane)	<2	ug/kg	U	EPA 8081	500	2	5
DO-E1	NON FILTERED	gamma-Chlordane	<0.005	ug/L	U	EPA 8081	5	0.005	0.05
DO-E2	NON FILTERED	gamma-Chlordane	<0.005	ug/L	U	EPA 8081	5	0.005	0.05
DO	RECEIVING WATER	gamma-Chlordane	<0.005	ug/L	U	EPA 8081	5	0.005	0.05
DO-E1	SEDIMENT	gamma-Chlordane	<1	ug/kg	U	EPA 8081	500	1	5
DO-E2	SEDIMENT	gamma-Chlordane	<1	ug/kg	U	EPA 8081	500	1	5
DO-E1	NON FILTERED	Heptachlor	<0.005	ug/L	U	EPA 8081	5	0.005	0.05
DO-E2	NON FILTERED	Heptachlor	<0.005	ug/L	U	EPA 8081	5	0.005	0.05

Station	SampleSource	Analyte	Result	Units	Qual	Method	DF	MDL	MRL
DO	RECEIVING WATER	Heptachlor	<0.005	ug/L	U	EPA 8081	5	0.005	0.05
DO-E1	SEDIMENT	Heptachlor	<2	ug/kg	U	EPA 8081	500	2	5
DO-E2	SEDIMENT	Heptachlor	<2	ug/kg	U	EPA 8081	500	2	5
DO-E1	NON FILTERED	Heptachlor Epoxide	<0.004	ug/L	U	EPA 8081	5	0.004	0.05
DO-E2	NON FILTERED	Heptachlor Epoxide	<0.004	ug/L	U	EPA 8081	5	0.004	0.05
DO	RECEIVING WATER	Heptachlor Epoxide	<0.004	ug/L	U	EPA 8081	5	0.004	0.05
DO-E1	SEDIMENT	Heptachlor Epoxide	<1	ug/kg	U	EPA 8081	500	1	5
DO-E2	SEDIMENT	Heptachlor Epoxide	<1	ug/kg	U	EPA 8081	500	1	5
DO-E1	NON FILTERED	Methoxychlor	<0.004	ug/L	U	EPA 8081	5	0.004	0.5
DO-E2	NON FILTERED	Methoxychlor	<0.004	ug/L	U	EPA 8081	5	0.004	0.5
DO	RECEIVING WATER	Methoxychlor	<0.004	ug/L	U	EPA 8081	5	0.004	0.5
DO-E1	SEDIMENT	Methoxychlor	<2	ug/kg	U	EPA 8081	500	2	50
DO-E2	SEDIMENT	Methoxychlor	<2	ug/kg	U	EPA 8081	500	2	50
DO-E1	NON FILTERED	Toxaphene	<0.1	ug/L	U	EPA 8081	5	0.1	5
DO-E2	NON FILTERED	Toxaphene	<0.1	ug/L	U	EPA 8081	5	0.1	5
DO	RECEIVING WATER	Toxaphene	<0.1	ug/L	U	EPA 8081	5	0.1	5
DO-E1	SEDIMENT	Toxaphene	<273	ug/kg	U	EPA 8081	500	273	450
DO-E2	SEDIMENT	Toxaphene	<273	ug/kg	U	EPA 8081	500	273	450
DO-E1	NON FILTERED	Aroclor-1016	<0.7	ug/L	U	EPA 8082	5	0.7	1
DO-E2	NON FILTERED	Aroclor-1016	<0.7	ug/L	U	EPA 8082	5	0.7	1
DO	RECEIVING WATER	Aroclor-1016	<0.7	ug/L	U	EPA 8082	5	0.7	1
DO-E1	SEDIMENT	Aroclor-1016	<54	ug/kg	U	EPA 8082	500	54	100
DO-E2	SEDIMENT	Aroclor-1016	<54	ug/kg	U	EPA 8082	500	54	100
DO-E1	NON FILTERED	Aroclor-1221	<0.7	ug/L	U	EPA 8082	5	0.7	1
DO-E2	NON FILTERED	Aroclor-1221	<0.7	ug/L	U	EPA 8082	5	0.7	1
DO	RECEIVING WATER	Aroclor-1221	<0.7	ug/L	U	EPA 8082	5	0.7	1
DO-E1	SEDIMENT	Aroclor-1221	<54	ug/kg	U	EPA 8082	500	54	100
DO-E2	SEDIMENT	Aroclor-1221	<54	ug/kg	U	EPA 8082	500	54	100
DO-E1	NON FILTERED	Aroclor-1232	<0.7	ug/L	U	EPA 8082	5	0.7	1
DO-E2	NON FILTERED	Aroclor-1232	<0.7	ug/L	U	EPA 8082	5	0.7	1
DO	RECEIVING WATER	Aroclor-1232	<0.7	ug/L	U	EPA 8082	5	0.7	1
DO-E1	SEDIMENT	Aroclor-1232	<54	ug/kg	U	EPA 8082	500	54	100
DO-E2	SEDIMENT	Aroclor-1232	<54	ug/kg	U	EPA 8082	500	54	100
DO-E1	NON FILTERED	Aroclor-1242	<0.7	ug/L	U	EPA 8082	5	0.7	1
DO-E2	NON FILTERED	Aroclor-1242	<0.7	ug/L	U	EPA 8082	5	0.7	1
DO	RECEIVING WATER	Aroclor-1242	<0.7	ug/L	U	EPA 8082	5	0.7	1
DO-E1	SEDIMENT	Aroclor-1242	<54	ug/kg	U	EPA 8082	500	54	100
DO-E2	SEDIMENT	Aroclor-1242	<54	ug/kg	U	EPA 8082	500	54	100
DO-E1	NON FILTERED	Aroclor-1248	<0.7	ug/L	U	EPA 8082	5	0.7	1

Station	SampleSource	Analyte	Result	Units	Qual	Method	DF	MDL	MRL
DO-E2	NON FILTERED	Aroclor-1248	<0.7	ug/L	U	EPA 8082	5	0.7	1
DO	RECEIVING WATER	Aroclor-1248	<0.7	ug/L	U	EPA 8082	5	0.7	1
DO-E1	SEDIMENT	Aroclor-1248	<54	ug/kg	U	EPA 8082	500	54	100
DO-E2	SEDIMENT	Aroclor-1248	<54	ug/kg	U	EPA 8082	500	54	100
DO-E1	NON FILTERED	Aroclor-1254	<0.7	ug/L	U	EPA 8082	5	0.7	1
DO-E2	NON FILTERED	Aroclor-1254	<0.7	ug/L	U	EPA 8082	5	0.7	1
DO	RECEIVING WATER	Aroclor-1254	<0.7	ug/L	U	EPA 8082	5	0.7	1
DO-E1	SEDIMENT	Aroclor-1254	<54	ug/kg	U	EPA 8082	500	54	100
DO-E2	SEDIMENT	Aroclor-1254	<54	ug/kg	U	EPA 8082	500	54	100
DO-E1	NON FILTERED	Aroclor-1260	<0.7	ug/L	U	EPA 8082	5	0.7	1
DO-E2	NON FILTERED	Aroclor-1260	<0.7	ug/L	U	EPA 8082	5	0.7	1
DO	RECEIVING WATER	Aroclor-1260	<0.7	ug/L	U	EPA 8082	5	0.7	1
DO-E1	SEDIMENT	Aroclor-1260	<54	ug/kg	U	EPA 8082	500	54	100
DO-E2	SEDIMENT	Aroclor-1260	<54	ug/kg	U	EPA 8082	500	54	100
DO-E1	NON FILTERED	Aroclor-1262	<0.7	ug/L	U	EPA 8082	5	0.7	1
DO-E2	NON FILTERED	Aroclor-1262	<0.7	ug/L	U	EPA 8082	5	0.7	1
DO	RECEIVING WATER	Aroclor-1262	<0.7	ug/L	U	EPA 8082	5	0.7	1
DO-E1	SEDIMENT	Aroclor-1262	<54	ug/kg	U	EPA 8082	500	54	100
DO-E2	SEDIMENT	Aroclor-1262	<54	ug/kg	U	EPA 8082	500	54	100
DO-E1	NON FILTERED	Aroclor-1268	<0.7	ug/L	U	EPA 8082	5	0.7	1
DO-E2	NON FILTERED	Aroclor-1268	<0.7	ug/L	U	EPA 8082	5	0.7	1
DO	RECEIVING WATER	Aroclor-1268	<0.7	ug/L	U	EPA 8082	5	0.7	1
DO-E1	SEDIMENT	Aroclor-1268	<54	ug/kg	U	EPA 8082	500	54	100